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No. XVI

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CHRISTIAN A. R

STUDIE
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UNDER THE DIR

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UNIVERSITY OF IOWA STUDIES IN PSYCHOLOGY

No. XVIII

EDITED BY

CHRISTIAN A. RUCKMICK

STUDIES IN THE PSYCHOLOGY OF ART

UNDER THE DIRECTION OF

NORMAN C. MEIER

PUBLISHED FOR THE AMERICAN PSYCHOLOGICAL ASSOCIATION BY

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PREFACE

With this volume we are inaugurating a new type of contribution to our series of publications from the Psychological Laboratories of the University of Iowa. The field of investigation here represented is not new to our laboratory, but for the first time we have brought together researches relating to the psychology of that branch of art represented by painting and sculpture. The plastic and graphic arts, those which appeal to visual perception, are herein made the object of serious and systematic study from their mental aspect.

For many years Professor Norman C. Meier has been responsible for directing experiments in this field of investigation. He has mapped out the territory, initiated the lines of attack, devised fruitful techniques of analysis, and guided a large number of graduate students through theses that are gaining the recognition of thoughtful enthusiasts in this scientific work. The studies fall within the range of artistic creation, of æsthetic appreciation, of affective reaction to visual form, to color-placement and harmony, of visual sensitivity and response to perceived relationships and imaged proportions. The artistic environment and innate æsthetic capacities and growing abilities of children of several age-levels in these directions are drawn upon for detailed scrutiny.

The volume again illustrates the happy affiliations between the various sections of our far-flung enterprise. Without the co-operation of the Iowa Child Welfare Research Station and without the availability of outside funds, these researches would not have been possible. Nor could we have assembled this volume without the willingness of the several authors to conform to the standards set for the publication of their studies in this series and without the untiring effort of the director of these contributions, Dr. Norman C. Meier, who brought them into being, regulated their development, and gave them their preliminary form for printing. For all of these things the editor is deeply grateful.

THE EDITOR

Iowa City, Iowa
7 June, 1933

INTRODUCTION

by

NORMAN CHARLES MEIER

The eleven studies in this monograph come from the Psychology of Art section of the Iowa Laboratory, all having been made under the direction of the undersigned. All except one are concerned with various aspects of artistic capacity. The subjects for the most part were children between the ages of two and ten years. It will be recognized at once that the use of children as subjects introduced difficulties that were augmented by the intangible character of the subject matter—applied æsthetics. The first condition was met by co-operation with the Iowa Child Welfare Research Station and by insistence upon the principle that all techniques employed must be appropriate to and well within the comprehension-level of all children to be studied; if no suitable ones could be found or adapted, new ones would be devised. The second condition was measurably aided by recourse to previous investigations of the director.

In projecting the first five studies the hypothesis was adhered to that the various phases of artistic capacity probably have a genetic emergence, the exact nature of this emergence being unknown. The position, also laid down in earlier work of the director (and adopted by others), that æsthetic sensitivity, measurable through æesthetic qualities or principles of art, constitutes the most certain index to artistic capacity. The studies in their findings point to the conclusion that children not only do respond positively to the more fundamental æsthetic qualities or principles but do so, as in the case of balance and rhythm, as early as the second or third year in certain individuals and by the fifth year in significant group averages. Unity and fitness show up in group averages several years later but color harmony not until nearly the twelfth year. These findings would indeed tend to

support the view that "æsthetic intelligence" as an important element in artistic genius matures early in life.

The second series of studies *(Grippen, Dow, Rodgers,* and *Tiebout)*, unlike the first series which used unselected subjects, made use of only a limited number of carefully selected extreme types, the X-group and the Z-group. The X-group comprised children, aged five to ten years whose art products, ratings by teachers, observers and research assistants, and scores on the *Kline-Carey* Scale, marked them as definitely superior artistically. The Z-group included those at the lower end of the ratings. This use of contrast was employed to throw in high relief the differences between the artistic and non-artistic personality. The four studies enjoyed the considerable advantage, infrequently realized in research, of having access to auxiliary and corroborative data from other projects in progress. With a given painting produced on the easel, the antecedent experiences of the child could, in most instances, be traced, opening up to the investigator verifiable insight into the child's imaginative and reproductive mental processes. The *Rodgers* study attempted a quantification of the probable æsthetic (total) stimulus affecting each subject, with a view toward establishing the relation between the æsthetic character of environment and presence or absence of artistic talent. The *Tiebout* investigation sought, by measurements of sensory, motor, and higher mental processes, to discover those capacities and abilities high degrees of which marked the superior from the artistically inferior child. This study suggests that more than anything else the artistically promising child is marked by the way he responds to his visual world.

While interesting observations might be drawn from the conclusions of these two studies, their application must be limited to the narrow field under investigation. Considerable further work is needed before these larger questions can have a more definite answer.

The *Dow* study is the first phase of a larger study of the activity and interest patterns of the artistic and non-artistic personality in its emergent stage. The *Dreps* study repeats, under different circumstances and under a different plan, the more

significant phases of *Manuel's* research made in 1916 at Illinois under the auspices of the General Education Board. Again here, the principle of contrast was employed, using only the best and poor or fair students from the Department of Graphic and Plastic Arts.

The *Jacobson* investigation attacked an almost baffling section of æsthetics for which there were neither guides nor landmarks. The situation was further complicated by two other factors: namely, the transient character of style and the limitation imposed by the use of costume-design as opposed to the gowned figure. The former difficulty was overcome by the experimental discovery that tangible æsthetic considerations exist in historic costume-design and are recognized even by laymen with style as a variable. The latter difficulty was reduced to a matter of inconsequence through rendering the designs virtually abstract. The study was carried through three phases: preliminary analysis of the factors in costume-design, a determination of the *basic* factors or those accounting for beauty, and an experimental determination of the underlying reasons for this basic or fundamental character. Appropriate techniques were developed for attacking each stage of the problem. *Dr. Jacobson's* study presents some surprising data on the objectivity of æsthetic value in costume-design. In the course of her project she enjoyed the generous co-operation of costume experts, art teachers, and other professionals, as well as lay subjects of a wide age-range.

The director of these studies wishes to acknowledge generous financial support from the Spelman Fund administered through the Iowa Child Welfare Research Station for the *Daniels, Jasper, Williams* and *Rodgers* studies. Staff members of the Station also aided with valuable suggestions and access to Station records. The *Tiebout* study likewise was aided by similar co-operation.

The *Walton, Grippen, Dow, Tiebout* and *Whorley* (in part) studies enjoyed financial support from a research fund given directly by the Carnegie Foundation for the Advancement of Teaching. The director is especially appreciative of the warm support and continued interest in these studies by Dr. Henry Suzzallo. The present program known as "Genetic Studies in

Artistic Capacity" is still in progress; later studies will appear in subsequent numbers of the Monographs.

The *Walton* study was a post-doctorate investigation, Dr. Walton being on leave from the University of Nebraska; the *Tiebout* and *Jacobson* studies were doctorate dissertations; the others were master's theses.

The color plates (*Williams* and *Grippen* Studies) were made possible through funds provided by the Carnegie Corporation of New York in co-operation with the American Federation of Arts, Conference for Research in Art.

Acknowledgment is due the score or more of artists (at New York, Taos, Santa Fé, Laguna Beach, and Carmel-Monterey) whose discussions with the director provided suggestions or ideas through which a check on the analysis of artistic talent was obtained.

Finally the expert services of Professor Ruckmick, as Editor of the Iowa Studies, are acknowledged for aid in preparing the volume for publication.

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DISCRIMINATION OF COMPOSITIONAL BALANCE AT THE PRE-SCHOOL LEVEL[1]

by

PARMELY CLARK DANIELS

I. Introduction. This study proceeds from the assumption that the æsthetic values of balance, rhythm, unity and a few other qualities are the most dependable criteria of value in art, and that the individual's sensitiveness to the presence of these qualities is the surest single indication of the existence of artistic capacity.[2] Hence a measure of such capacity would best be approached through the function of æsthetic judgment and so fundamental a capacity might reasonably be expected to be present even at childhood levels. If so, it would be important for our understanding of not only this but related forms of talent to discover if it is present at birth, or at what age level it appears in the median individual as well as in the gifted and retarded extremes.

No experimental facts directly concerned with this question have been discovered by the writer. One, that of *R. Washburn* (reported in *Baldwin* and *Stecher,* 2), touches upon symmetry, which is a form of balance. The child was required to execute a design in beads varying in shape and color; but out of 123 children ranging up to the fourth grade, only four showed a desire for symmetrical arrangement. A second experiment was a test of completing paper houses made with detachable parts in several sizes for adjustment by the children. Her results showed some desire on the part of the older children for vertical balance, but their constructions did not conform to the theoretically correct proportions outlined in *Robinson's* "Architectural Composition."

[1] Acknowledgment is made to Dr. Norman C. Meier, who planned the study, and to the Iowa Child Welfare Research Station, whose funds supported the research.

[2] Meier, N. C., Æsthetic Judgment as a Measure of Art Talent; also references **18** and **19**.

II. Experimental procedure. It was the purpose of this investigation (1) to devise a technique adjusted to the comprehension-level of the pre-school child permitting comprehension by a fair proportion of the two-year-old children and difficult enough to offer some degree of challenge to the six-year level, and (2) to apply this procedure so as to determine unequivocally the child's sensitivity to compositional balance. Secondary objectives were: (a) to determine if the capacity does appear at that level and, if so, (b) to determine individual differences in the degree of sensitivity, and (c) to determine if these differences are related to the child's intelligence or performance ability.

III. Compositional balance. The term 'balance' as applied to composition in the graphic and plastic arts refers most frequently to an unsymmetrical form of equilibrium. Most of the well-known compositions of Corot illustrate this arrangement of elements. Approximations of formal symmetrical balance occur in many of the Madonna pictures of medieval painters. Almost without exception balance is recognized by æstheticians and laymen alike and it is described by writers as being founded upon such considerations as stability, *Einfühlung* (empathy), æsthetic repose and like terms. Three general types are recognizable: bilateral, radial, and vertical balance. Occult balance is the term usually employed in speaking of asymmetrical balance, which because of its complexity can not be well employed in this study. Bilateral balance, or 'symmetry right and left' as it is sometimes called, is found in nature in the shapes of leaves, the human form, and most living things, where the two sides about an axis are similar but reversed. Radial balance is the symmetry found in trees, flowers, mushrooms, starfish, snow crystals, and the like, where the elements are opposed equally about a central axis. Vertical balance or stability is found in mountains, balanced rocks, ant-hills, and the like. It is highly probable that experience and environment play an important part in the appreciation of balance because of this close relation of equilibrium and the numerous examples afforded by nature.

IV. Apparatus. The problem presented itself as one testing the possibilities of balance-discrimination in the child yet involv-

ing the use of materials and problems within the comprehension of the two-year old child. It was of first importance to avoid language responses altogether, since these in the pre-school child are seldom dependable and in some instances are definitely misleading. It was therefore planned to place prime dependence upon a behavior-response using language merely to check this response. Since color, perspective representation, medium of notation, and such considerations would complicate matters, it was planned to avoid these as far as possible. After experimenting with clay and plaster-of-paris, it was found that they were impracticable because of being fragile and not readily adaptable to the procedure. Specially selected wooden blocks were decided upon because the child is familiar with them; they could be used repeatedly for different compositions and were furthermore indestructible, capable of æsthetic treatment in color and proportion and lent themselves well to the experimental procedure. The blocks were all rectangular and made in simple fractional parts of the largest blocks. This greatly simplified the problem of construction both for the experimenter and the subject. The proportions of blocks were determined from the observations and studies of several investigators and teachers at the pre-school laboratories. They were constructed of maple, accurately cut in the University Cabinet Shop, and made to fit perfectly into any combination without distorting edges or outline. The dimensions of the various sizes follow:

3.500 in. x 3.500 in. x 3.500 in.
3.500 in. x 3.500 in. x 1.750 in.
3.500 in. x 1.750 in. x 0.875 in.
3.500 in. x 0.875 in. x 0.875 in.
1.750 in. x 0.875 in. x 0.875 in.
1.750 in. x 1.750 in. x 1.750 in.
1.750 in. x 1.750 in. x 0.875 in.

A sufficient number of each size was made to provide an adequate supply for three copies of each composition.

Because unpainted wood becomes easily soiled it was found advisable to lacquer the blocks with a neutral tone which would be interesting to the child while not presenting any particular color. Secondary colors are probably most attractive to the child

and by toning down the brilliance and chroma may be made unobtrusive. The color selected was mixed from vermillion, ultramarine, Indian red and Chinese white and applied with banana oil to produce a flat finish. The color produced was comparatively free from association and approximated, expressed in popular terms, a neutral rose tint. The coefficients of absorption of artificial ultramarine and Indian red are high and of Chinese white very low, the result being that surfaces in the shadow appeared very dark and surfaces facing the light appeared

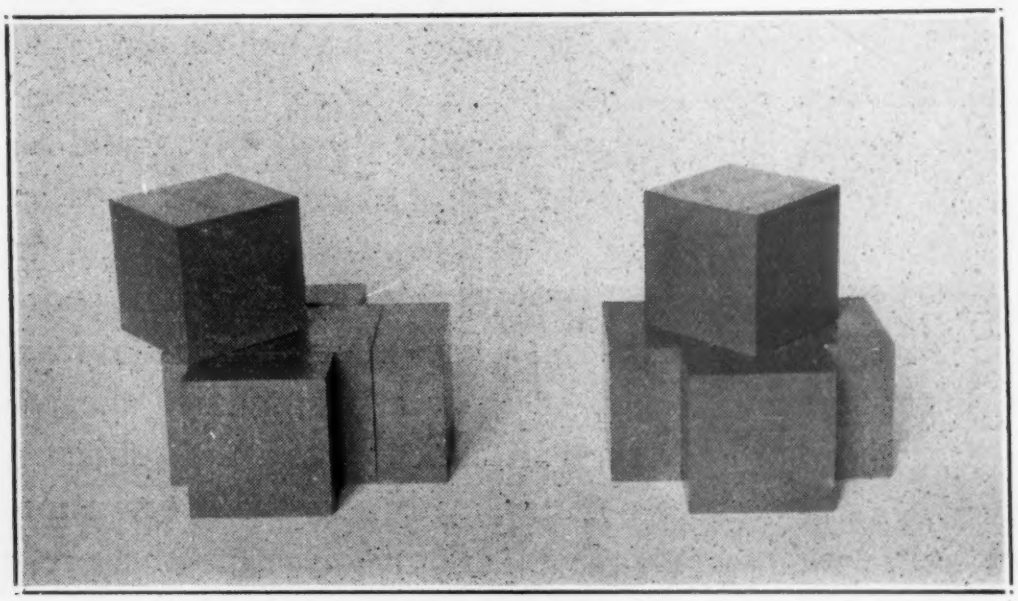

FIG. 1. Design No. 1.

very light. This contrast heightened the consciousness of perspective and produced a desirable condition since the child views the compositions from one angle during practically the whole experiment. Two display cases measuring 18 in. high, 19½ in. deep and 30 in. wide were built, with removable tops and French-plate glass fronts, lacquered a neutral gray, which together with a small chair, completed the apparatus and equipment.

V. Method of paired models. To assure control of all conditions apt to affect response, so that it should be possible to vary the factor of balance alone, the procedure was to prepare in advance a series of designs built of these blocks, to be built in pairs, one embodying compositional balance, the other unbalance. Both compositions were constructed about the same central theme; carried the same motifs; were of equal mass, equal unity,

equal number of blocks, the same kind and variety of blocks, and of the same color. The compositions were placed in the two identical cases to provide frame and space-relationship, to minimize the effect of proximity of one composition, and also to prevent the child from disturbing or destroying the models. The sets were designed to rest upon a low platform with both compositions squarely facing the subject, at equal distances behind the plate glass (.875 in.), and boxes at equal distances from the observer. A low chair was placed at the focal point where the child sat when making selections and judgments. Set A was built of six blocks; Set B, seven; Set C, eight; Set D, eighteen; and Set E, twenty-five. Set B was repeated in reverse order as a check on reliability. It will be noted that the balanced set appears spatially in a chance order of R, R, L, R, L, and L. In every trial the child was provided with a set of blocks identical in every way with those in the design except that they were unassembled. Set A, the simplest design, is illustrated in Fig. 1.

VI. Procedure. The child was brought into the experimental room and seated in a small chair before the sets. *E* waited for spontaneous reaction to the sets to note if evidence of discrimination was volunteered verbally or unconsciously demonstrated. The set-up then became like that illustrated in Fig. 2. The child's attention was directed to the blocks on the floor.

E: "Will you build one of these for me?" (indicating sets in cases). If no response follows he was urged with: "Build either one you want to—I know you can do it." (Figure 2.) The model attempted was recorded; also a rating of the relative success; likewise all significant remarks and activities. This provided the principal data of the experiment. Further data of a confirmatory character were then secured verbally. When the composition was completed, or the child stopped, *E* proceeded with, "Which one is that?" if there was the slightest possibility of doubt. Names were then sought for the models and the child's composition to check the abstractness of the models and the fertility of the child's associative imagination.

The child was then asked to resume his place on the chair, and

his attention was turned to the sets before him with the question, "Which one of these is the nicer?" Following this he was asked the reason for his preference and if none was forthcoming was asked (indicating the composition not chosen), "What's wrong with this one?" At times the procedure relative to this verification-phase was altered slightly when it seemed profitable

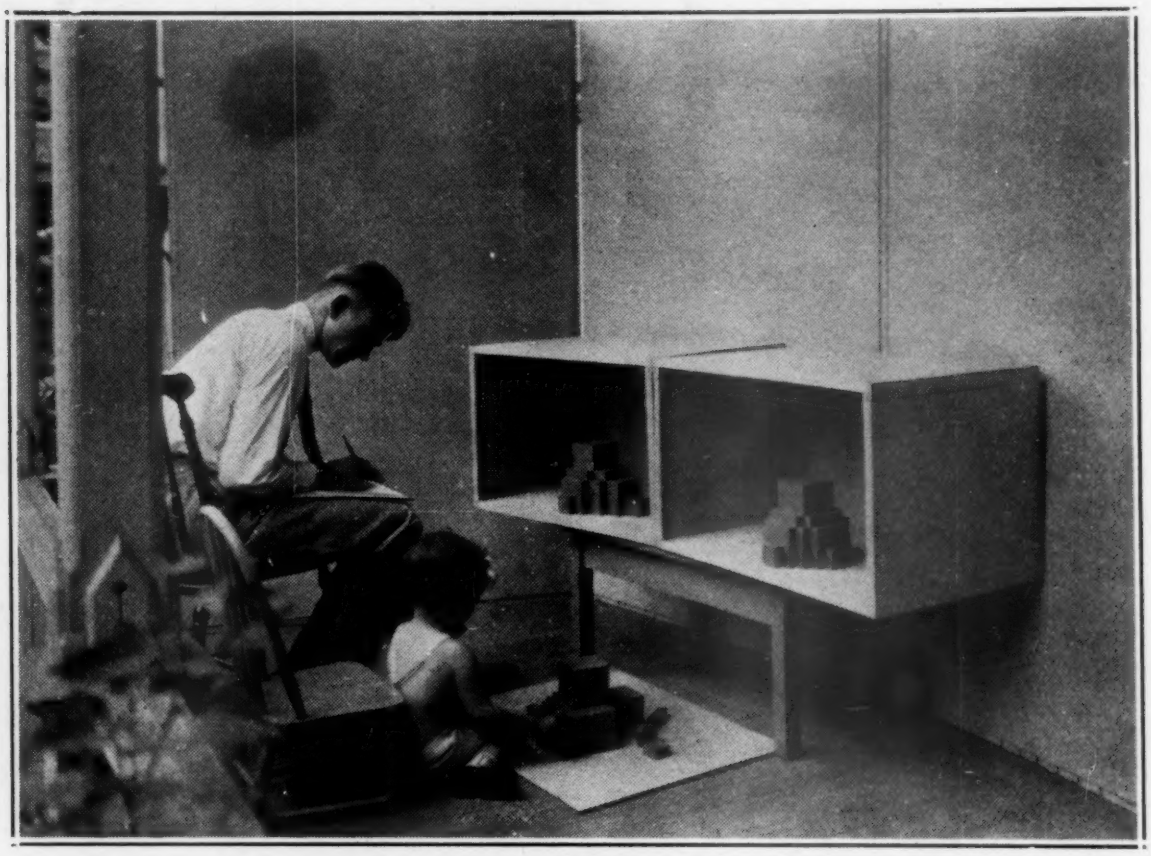

FIG. 2. Experimental situation.

to do so in an attempt to secure more complete data. For purposes of comparison spontaneous building activities from many of the children were also secured.

The subjects were 38 children in the University of Iowa Pre-School Laboratories, ranging in age from 2 yrs. 1 mo. to 5 yrs. 8 mos. The I.Q's. ranged from 65 to 149, with a median of 115. They came from average middle-west homes and were all normal children except one. Most of them were accustomed to laboratory procedure and usually waited for *E* to take the initiative in the conduct of the experiment.

Comments were recorded as responses (behavior or verbal) to these questions, applied at appropriate stages:

1. "Will you build one of these for me?"—indicating sets.
2. "Which one is that?"
3. "What is it?"—applying to child's own design.
4. "Which one of those is the nicer?"—indicating sets.
5. "Why?" If no response, "What's wrong with that one?"—indicating one not chosen.
6. "Will you build something for me out of these blocks?" "Build whatever you want to and make it as nice as you can." A notation in conformity with Child Welfare experimentation was followed throughout. (Question 6 was not applied to all subjects).

VII. Qualitative results. A few typical responses follow.[3]

♯471. G2–III A. 3–18. 9:35–9:41 A.M.[4]

1. "Yes." (Builds balanced composition similar to ♯1, looking at ♯1.)
2. "That one." (Points to ♯1)
3. "House".
4. (Firmly and promptly) "That one." (♯1)

♯370. G2–XIV B. 3–22. 9:15–9:24 A.M.

1. "Are they just the same?"
"No."
"This one's the same; it has the edge off."
2. "Look, it's this one. (♯1) (Makes perfect likeness of ♯1)
3. "I guess it's a hospital." (Puts it off balance and says) "Now it's like this one. (♯2) That's more like a church. It has a steeple."
4. "I like that one." (♯1)
5. "Because, it's easier." (♯1)

♯493. G2–I E. 4–5. 9:32–9:42.

1. "I'll make that one"(♯1). (Starts making ♯1 very conscientiously, but makes composition symmetrical.)
2. "There she is. How's that?"
3. "It's a house."
4. "They're both nice."
"But one's *nicer.*"
"That one"—indicating ♯1.

[3] The complete data may be examined in the University of Iowa Library (Master's Thesis, 1929).

[4] Notation is as follows: pre-school registration number of the subject, group 2 (4 yr. level), order in the group, class of design, date, time of trial. ♯1 refers to balanced, ♯2 to unbalanced design. In the first instance registration number = 471, G2 = group 2, III = third in group, A = first design, 3–18 = March 18, 9:35–9:41 A.M. = time of day.

VIII. Quantitative results. Data are presented showing total choices as expressed behavioristically in building one of two models; the total stated preferences; and in Table III, Results by Designs, a detailed analysis of the finding of the experiment. In arriving at "average success in construction" a rating form was employed as follows:

3. *Perfect* reproduction. All the blocks correctly placed, though perhaps a trifle loosely. *E* may start the theme (the foundation block or blocks being the same for both designs) or may encourage the child to continue, but no help given beyond starting the theme.
2. *Average.* A recognizable likeness of one of the compositions sufficient to distinguish it definitely from the other, but not a perfect model.
1. *Poor.* The result not readily recognizable or resulting from child having received considerable urging from *E*.
0. Attempted construction but no success. The range is from mere expressed intention to copy, to efforts diverted into the child's own composition.

Chiefly because of the difficulty of constructing a serviceable grading scale, no quantitative results are available for the child's spontaneous constructions, other than an analysis of the constructions with reference to type of balance or unbalance.

TABLE I. *Attempts at construction—Summary*

Balanced composition attempted	142
Unbalanced compositions attempted	18
Neither recognizable	18
Both attempted	7
Total attempts involved	185

TABLE II. *Stated preference—Summary*

Balanced compositions	135
Unbalanced compositions	31
No preference	10

TABLE III. *Analyses of child's original compositions*

Balanced	50
Balanced-radial symmetry	5
Balanced-bi-lateral symmetry	10
Balanced-vertical (stability)	7
Unbalanced	14

The relation of attempts *vs.* choices is shown in Tables I and II. It will be observed here that no significant figure falls below

chance or random choice, indicating that no child evinced a definite *preference* for unbalanced composition.

TABLE IV. *Results by designs*

Set No.	Attempts to build—total	Balanced constructions—total	Balanced Constructions: Perfect	Average	Poor	Unrecognizable	Unbalanced construction	Average success in const.-rating	Selection of balanced design (in cases) Per cent	Per cent balanced construction
A	34	27	5	12	10	7	1	1.46	97	79
B	37	32	9	18	5	5	6	1.74	86	86
C	30	22	5	12	5	8	9	1.41	77	73
D	27	25	11	9	5	2	5	1.90	84	93
E	20	16	0	9	7	4	9	1.21	69	80
B2	18	16	2	12	2	2	5	1.70	74	89

TABLE V. *Construction vs. discrimination; rank in order of facility of behavior selection or verbal choice*

Rank	Construction-facility	Discrimination-facility in per cent
1	D 1.90	A 97
2	B 1.74	B 86
3	B2 1.70	D 84
4	A 1.46	C 77
5	C 1.41	B2 74
6	E 1.21	E 69

Correlations were computed for

(a) Intelligence (Binet-Simon-Stanford) and the balance discrimination ratings ($N = 37$) $r = .197 \pm .105$

(b) Ratings on construction-success and balance-discrimination ($N = 37$) $r = .022 \pm .109$

Reliability (repetition of Design B) was .753

IX. Summary. 1. The procedure and technique devised for the measurement of balance-discrimination at the pre-school level was found applicable and reasonably reliable within that range of ability to construct and to discriminate.

2. Experimental evidence, beyond the possibility of chance, showed that at the pre-school level balance in tri-dimensional designs is preferred to unbalance.

3. Verbal corroboration was also strongly in support of the finding and only in slightly less degree than the objective evidence.

4. Individuals vary greatly in their capacity to discriminate with respect to compositional balance in tri-dimensional designs.

5. Individuals vary greatly in their ability to reconstruct simple compositions from a model.

6. The ability to reconstruct, at least in the relatively simple conditions of this experiment, is not correlated with æsthetic discrimination ($r=.022\pm.109$). The small number of cases (37) makes this conclusion only tentative.

7. Æsthetic discrimination of balance is not highly correlated with general intelligence as measured by the Stanford Revision of Binet-Simon test ($0.193\pm.105$).

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THE SENSITIVITY OF CHILDREN OF PRE-SCHOOL AGE TO RHYTHM IN GRAPHIC FORM [1]

by

CONSTANCE C. JASPER

This investigation is related to studies of *Daniels* (4), *Whorley* (23), and *Walton* (21) which investigated the sensitivity of children to the art principles of balance, unity-fitness, and color harmony respectively. This study assumed for its objective the capacity of the child of two to six years of age to respond positively to graphic rhythm by regular repetition in two-dimensional form. The primary interest was to find the age at which it appears in a statistically significant proportion of the child population and whether this appearance is gradual, abrupt or in the pattern of a rapid emergence. Incidental objectives were correlations of the findings with general intelligence, chronological age, and responses to rhythm in music.

Next to balance, rhythm may be regarded as one of the oldest known and accepted qualities in art, appearing both in nature (undulating grain field, surf), and in man-made compositions. That it makes its appearance early in the activities of children is generally believed but not definitely known. *Cockrell* (3), in her analysis of 1,550 spontaneous (uninstructed) paintings of preschool children, found "One of these qualities is freedom and grace of movement, combined with a sort of naïve self-confidence resulting in . . . movement or rhythm. . . . Among these paintings there are some which justify us in crediting children with the ability to create movement, rhythm and harmony." *Sears* (18) studied perception of rhythm by children in nursery rhymes and jingles, rhythmic exercises and in music. Among

[1] A part of the University of Iowa program of research in the nature and genesis of artistic talent, under the direction of Dr. Norman C. Meier. Acknowledgment is made to the Iowa Child Welfare Research Station for subjects and suggestions, and for financial support.

other conclusions it was held that rhythm develops early in life and that it appears in appropriate activities through which rhythm may be expressed. *Washburn* (22) experimented with bead stringing designs and with paper houses on children from pre-school age through fourth grade, but found little evidence for rhythm perception at any of the ages studied.

Experimental procedure. Definitions of rhythm agree in implying measured movement or a sequence of units in a regular, orderly and measured progression, leading the eye to a certain point without interruption, and in assuming that it affords pleasure. Selected characterizations are: ". . . flow-rhythm in art gives a movement or condition of line that takes hold of all kinds of apparently irrelevant details and gives them coherence" (*Pearce,* 13); ". . . a regularity of changes in a regularity of measures, with effect of movement on our minds" . . . "causes the eye to move in one direction rather than another" (*Ross,* 17). By *Goldstein* (9) rhythm is regarded as related movement and is obtained in three outstanding ways: by repetition of shapes, by progression of lines, and by easily connected or continuous line-movement. *Seashore* (19) characterizes it as "an instinctive disposition to group recurrent sense impressions vividly and with precision."

In this investigation only the simpler forms of graphic rhythms could be explored, compositional and color-rhythms being too difficult for children of these ages. Appropriate experimental material would need to be (a) well within the comprehension level of two-year olds and of sufficient interest and difficulty to afford a problem for six-year old children as well, (b) of material and subject matter that is familiar to practically all the children serving as subjects and (c) of sufficient variety and number to sample adequately the customary forms in which rhythm occurs.

Preliminary investigation. Five pairs of simple abstract designs were made. These were linear repetitions of simple geometric forms in black silhouette on cream detail paper, the designs being 2¼ in. in height and mounted on gray cardboard 36 in. x 24 in. There was one rhythmic and one arhythmic design in each pair. To make more certain that the element of

movement was present the tests were given to 35 adults who had had no art training in schools and were not familiar with design principles as such. Preferences and reasons therefor were secured, with the result that 90 per cent of 175 choices were for the rhythmic and only 10 per cent for the arhythmic designs. Typical reasons assigned were "because it is neat" (order of arrangement) and "it seems to move right along" (movement and regularity), implying that the eyes of the observer were carried from one unit of the design to the next in a definite direction. This seemed to justify the experimenter's belief that such material did have the art principle of rhythm. Accordingly additional designs were made and a considerable portion of pictorial material of the kind that normally interests children (pets and toys) was introduced. Color-mosaics and color-triangles were also investigated as possibilities but judged impracticable.

First phase of the investigation. Two tests of two-dimensional design forms were devised. The first consisted of five pairs of abstract designs in black silhouette on cream detail paper, one rhythmic and one arhythmic. The geometric forms were the same in each case, the arrangement being the only factor varied. The second test consisted of four pictorial border designs having as motifs ducks, children, birds, and boats. There were four repetitions of the unit in each border and two empty spaces in which the child was to place two of four cards similar to the units in the border. Of these four cards two were exactly like the units in the border and two were different. The designs were painted with water color, every unit in each border being the same.

In the testing-room the child was shown the abstract designs first. He was asked to look at them carefully while the experimenter traced the outline of the silhouette, at the same time saying the direction of the movement of the design, *i.e.*, "Up, down, up, down." The child was then asked to trace the designs himself, look at them again and choose which one he liked the better of the two. This procedure was repeated for each of the five pairs.

A second time in the testing-room the subject was shown the

first of the four pictorial borders. After he had observed the whole border carefully, the four supplementary cards were laid before him just below the border, care being taken that the rhythmic cards did not come directly under the places to be filled. After looking at each card and the whole border again the child made his choice of the two to be placed in the empty spaces. This procedure was repeated for the other three designs of the

FIG. 1. Experimental situation.

series. As a check the series was given to each child three different times.

The 52 subjects used for this phase of the study were grouped as follows: 2 yr. level, 7; 3 yr. level, 7; 4 yr. level, 14; 5 yr. level, 9; 6 yr. level, 15.

The results of this preliminary phase of experimentation were somewhat uncertain, giving grounds for doubt that the materials were within the comprehension of the younger groups. The abstract designs on the first trial showed in total rhythmic scores only 14 points better than chance. With the pictorial tests this was 25 points less than chance. These results with the younger

children pointed to the necessity for a revision of technique and materials. Hence the tests were reconstructed in an effort to make them simpler, more thorough and more suitable for the younger children.

In the revised form of the tests the kinæsthetic and auditory cues of tracing the designs and saying the direction of movement were eliminated from the procedure. The rhythm of the designs was emphasized by adding more units to each border. To make a greater difference between the rhythmic and arhythmic designs the arrangement of the arhythmic ones was still further disrupted. Only one empty space was left in the pictorial borders in this form, and only one of the four substitution cards was like the units in the border. This decreased somewhat the possibility of the child making rhythmic responses by chance. In order to make some check against the influence of a possible story element in the pictorial borders, a series of abstract designs was made. These were the same in number as the pictorial borders and the same technique was used in presenting them to the child. In addition to the two tests previously described two more tests were devised. The complete series used in the final phase were as follows:

A. Six pictorial border designs in color, having as motifs rabbits, ducks, children, birds, dogs and boats. There were seven repetitions of each unit in each border and one empty space to be filled by the child. The empty space was placed near the end of the series of units so the swing of the movement could be felt before the interruption occurred. Of the four substitution-units one was going the same direction as the ones in the border, one the opposite direction and two were doing something entirely different, so that the only element varied was direction of movement. If any of the three different units were placed in the space, the continuous rhythmic movement of the whole border was broken.

. In the testing-room the subject was shown the first of the six borders and after he had observed it very carefully the four supplementary cards were laid before him just below the border, care being taken that the rhythmic card did not come under the space

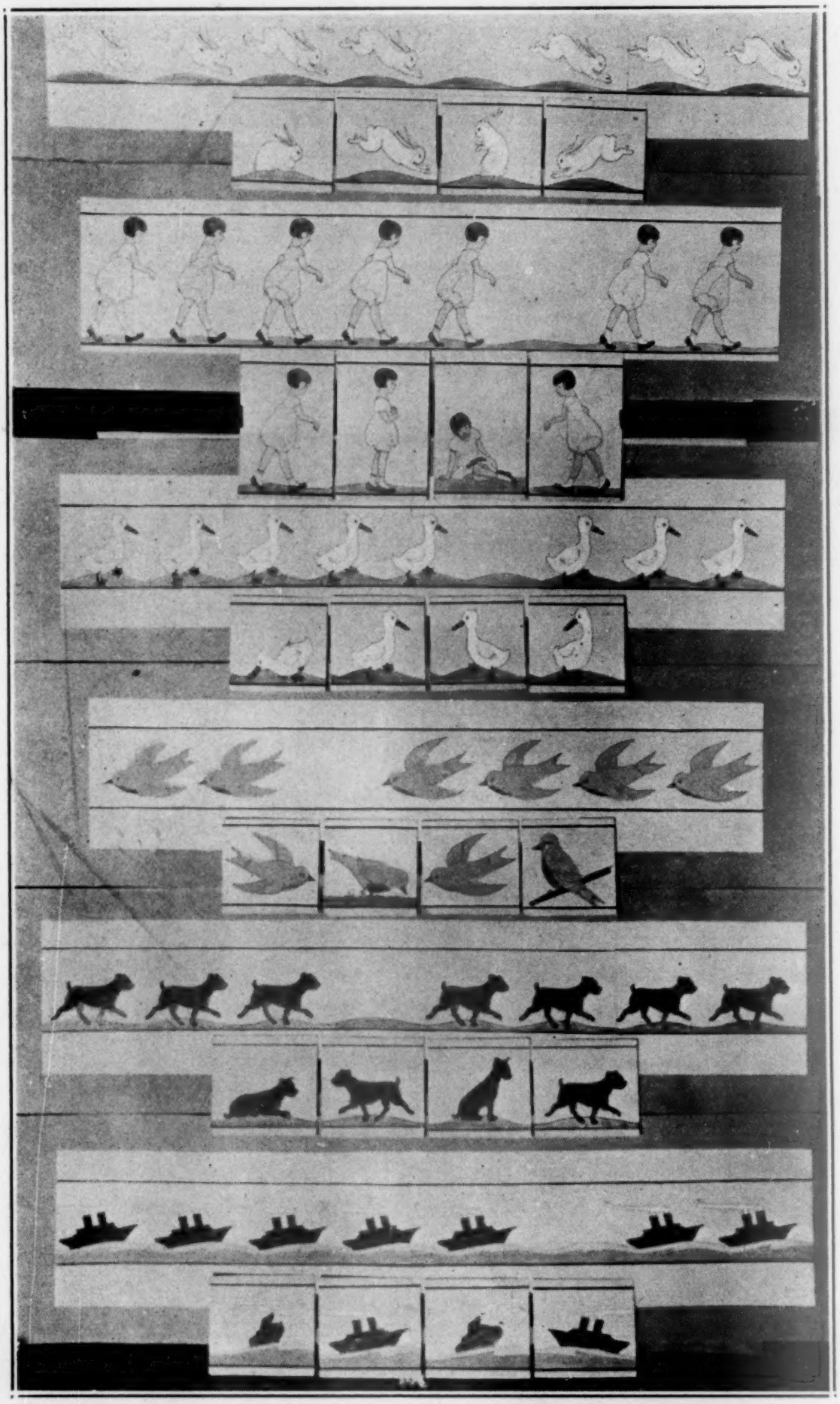

FIG. 2. Pictorial design materials (completion technique).

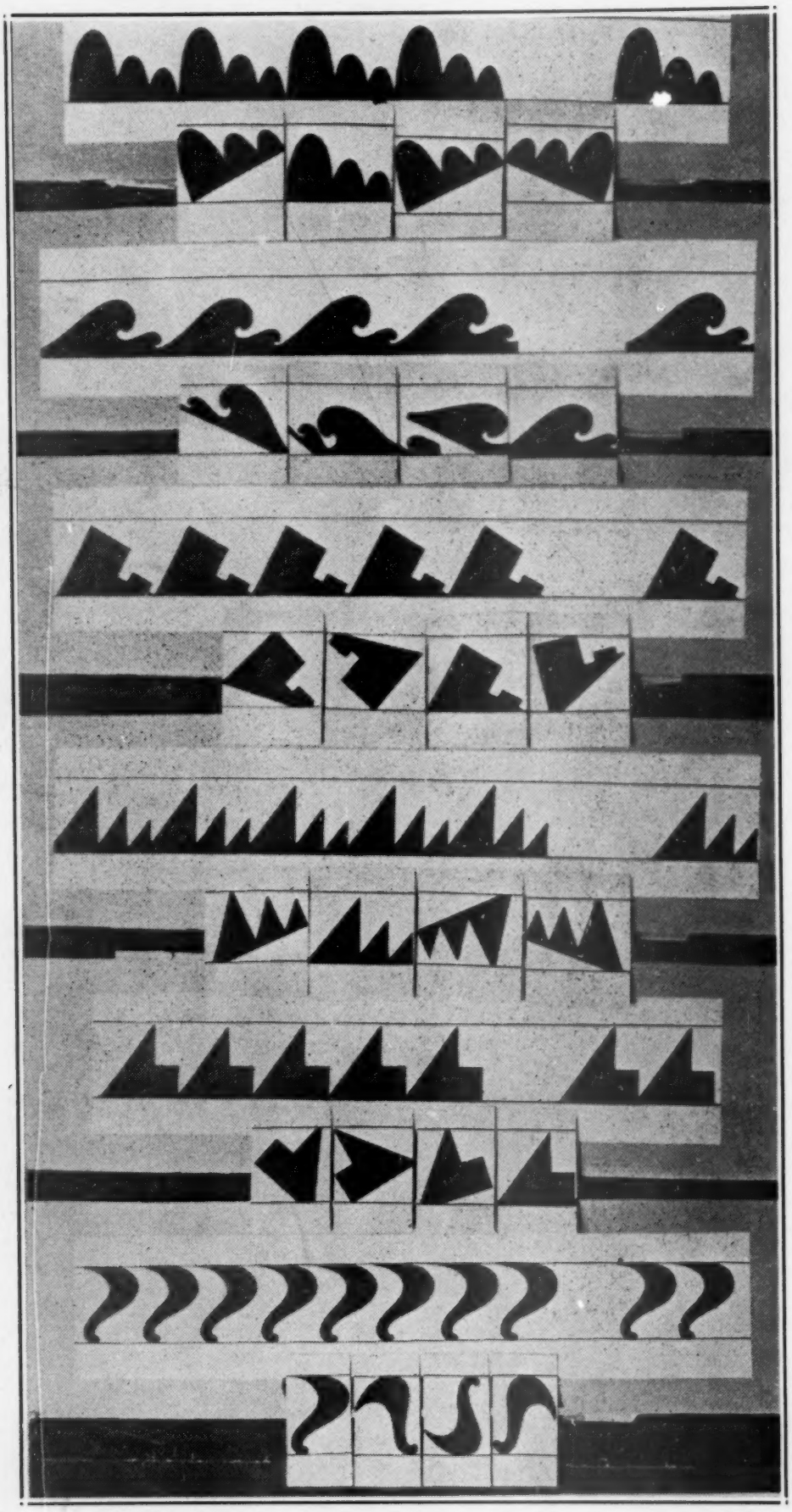

FIG. 3. Abstract design materials.

to be filled. After trying each card in the space and looking at the whole border again the child was asked to choose which card he thought looked the best with all the other objects in the border. The same procedure was used for each of the six designs, the placing of the rhythmic card being different each time.

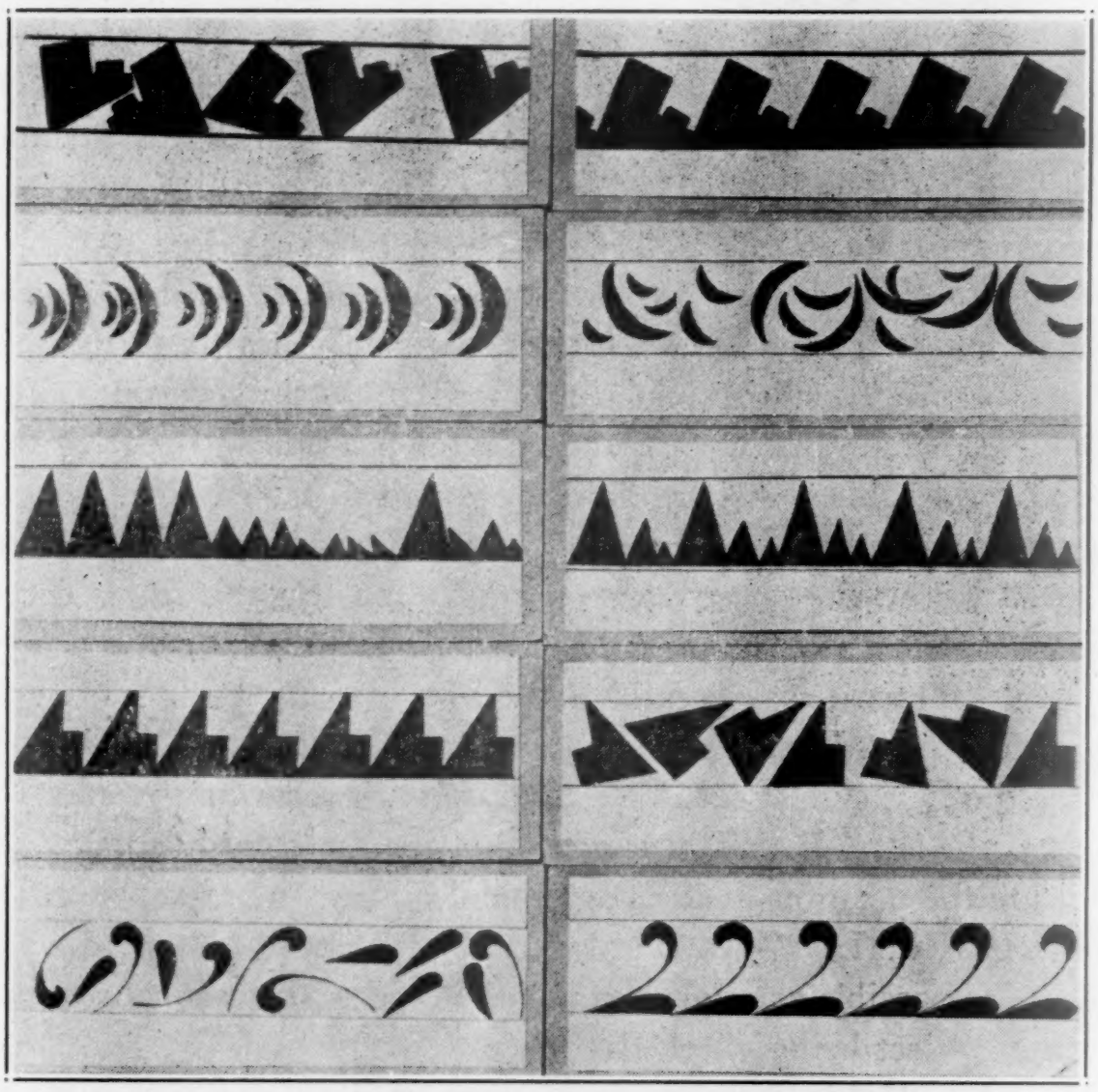

FIG. 4. Dual choice technique.

B. Six abstract border designs in black silhouette on cream detail paper. There were five to seven repetitions of a given unit in each border and one empty space in which the child was to place one of four cards shown to him. The technique for giving the test was the same as for the pictorial borders.

C. Twelve pairs of abstract border designs in black silhouette on cream detail paper. Each border was mounted on a grey card 6½ in. x 2½ in., and contained five to seven repetitions of a given

unit. There was one rhythmic and one arhythmic design in each pair. The subject was shown one pair of designs at a time and asked to tell which one of the two he liked the best. The position of the rhythmic member was alternated, to compensate for possible space or position error.

D. Veneer-board blocks cut in abstract designs and lacquered red. The blocks were shown and used on a grey display-board slanting at a 45 degree angle before the child. On the display-board were two rows of blocks, one rhythmic and one arhythmic. The child was asked to look at them both carefully and then make one of his own.

Scoring Procedure: The method of recording results was the same for tests A and B. When the four substitution-cards were placed before the subject, an R was written on the recording sheet above the square that corresponded to the position of the rhythmic card on the table. As the child proceeded in trying each card in the empty space of the border design the number of the trial was written below the corresponding square on the recording sheet. When the final choice was made a check was made in the proper square. Thus it was possible to tell by inspection of the record whether the child chose by position only, or whether he always chose the first or last card he picked up. In recording results for Test C the letter R or L was written after the record of choice to indicate the position of the rhythmic design with reference to the subjects R or L. The record form for Test D contained a list of all the possible arrangements of the blocks, the one constructed by the subject being checked.

Results: Table I gives the number of rhythmic responses to each item at the four age-levels. These results show a high degree of consistency in the total number of rhythmic responses to each item of the test. It is evident also that there is an increase in rhythmic response with increase in chronological age.

In order to secure a composite score for the four tests the formula $E=50-\frac{R-M}{\frac{6}{10}}$ was employed, in which E is the equated score (later combined with the E of other tests to form the com-

posite score); R, the raw score ; M, the group mean of the raw scores for that test and 50 represents the arbitrarily assumed mean in the equated score. By using this formula one standard deviation is equal to 10. The range of these composite equated scores was from 136 to 250.

TABLE I. *Summarized gross data;* No. of rhythmic responses to each item of each test at the four age-levels used.

Age-levels	Test A (Pictorial)						Test B (Abstract)					
Item no.	1	2	3	4	5	6	1	2	3	4	5	6
3 yr. N = 21	10	7	5	9	5	10	5	2	3	5	4	2
4 yr. N = 22	9	7	4	7	11	7	7	8	7	4	3	4
5 yr. N = 29	15	18	13	16	15	18	18	15	12	16	13	15
6 yr. N = 40	33	30	31	26	32	32	38	36	37	34	35	30
Total	67	62	53	48	63	67	68	61	59	60	55	51

Age-levels	Test C (Pairs of Abstract Designs)												Test D (Blocks)				
Item no.	1	2	3	4	5	6	7	8	9	10	11	12		1	2	3	4
3 yr. N = 21	9	9	5	9	11	7	6	7	11	7	11	9	N = 23	3	3	3	3
4 yr. N = 22	9	7	8	6	10	10	6	6	7	12	9	8	N = 8	1	2	0	2
5 yr. N = 29	17	17	8	18	13	17	17	13	17	16	14	15	N = 10	5	6	6	6
6 yr. N = 40	24	26	11	25	28	24	23	18	24	27	25	23	N = 22	18	14	18	18
Total	59	59	32	58	62	58	52	44	59	62	59	55		27	25	27	29

TABLE II. *Intercorrelations*

Tests	Raw C	Correction for attenuation	PE
A–B	.70	.88	± .01
A–C	.49	.61	± .04
A–D	.68	.85	± .02
B–C	.62	.76	± .03
B–D	.75	.91	± .01
C–D	.69	.84	± .02

TABLE III. *Self-correlations*

Tests	Raw C	Spearman correction	PE
A	.61	.76	± .03
B	.65	.79	± .02
C	.67	.80	± .02
D	.70	.82	± .03 (63 cases)

Reliability and validity of the tests. For determining the reliability the odd-numbered items were correlated with the even-numbered items within each test. Because of the small number of classes in these calculations it was necessary to use the coefficient of contingency method. These results appear in Tables II and III. In addition reliability was computed for two age-

groups (31–54 mos. and 55–79 mos.), the results appearing in Table IV. The contingency method was used in these calculations except for test D where the limited classes made it necessary to present the results in percentage relationships. (Table V.)

TABLE IV. *Self-correlations for two age-groups (contingency coefficient)*

Test	Raw C	Correction for attenuation	PE
		Lower age group	
A	(.26)	.41	± .05
B	(.54)	.70	± .03
C	(.62)	.76	± .03
		Upper age group	
A	(.64)	.78	± .02
B	(.70)	.82	± .02
C	(.78)	.87	± .01

TABLE V. *Reliability in terms of the per cent of cases falling into the same groups of scores on odd and even items*

Whole group

Test A odds	evens	%	Test B odds	evens	%	Test C odds	evens	%	Test D odds	evens	%
0	0		0	0		1	1		0	0	89
		75			89	2	2	78	1	1	60
1	1		1	1		3	3		2	2	83
2	2		2	2		4	4				
		85			80	5	5	70			
3	3		3	3		6	6				
		N=112					N=86			N=63	

Lower Group 31–54 months

0	0		0	0		1	1		0	0	88
		70			94	2	2	80	1	1	66
1	1		1	1		3	3		2	2	50
2	2		2	2		4	4				
		70			33	5	5	30			
3	3		3	3		6	6				
		N=44					N=26			N±35	

Upper Group 55–79 months

0	0		0	0		1	1		0	0	100
		82			78	2	2	62	1	1	55
1	1		1	1		3	3		2	2	86
2	2		2	2		4	4				
		88			90	5	5				
3	3		3	3		6	6				
		N=67					N=41			N=51	

Since these tests are original with no ready criterion of validity it was necessary to use an indirect method to determine validity. Each test was correlated with the combined scores of

all four of the tests, using the product-moment formula. These results follow in Table VI.

TABLE VI. *Correlation of each test with total score*

Test		r	PE	No. cases
A		.77	±.02	112
B		.80	±.02	112
C		.67	±.03	112
D	C=	.74	±.04	63

Relation of rhythm to intelligence, chronological age, sex, and tapping rhythm. The correlation between chronological age and design rhythm was found to be .69±.036 for the 112 subjects. It was evident from inspection of the results in Table I that there is a definite increase in score with chronological age which appeared to accelerate up to some point near the fifth year. The

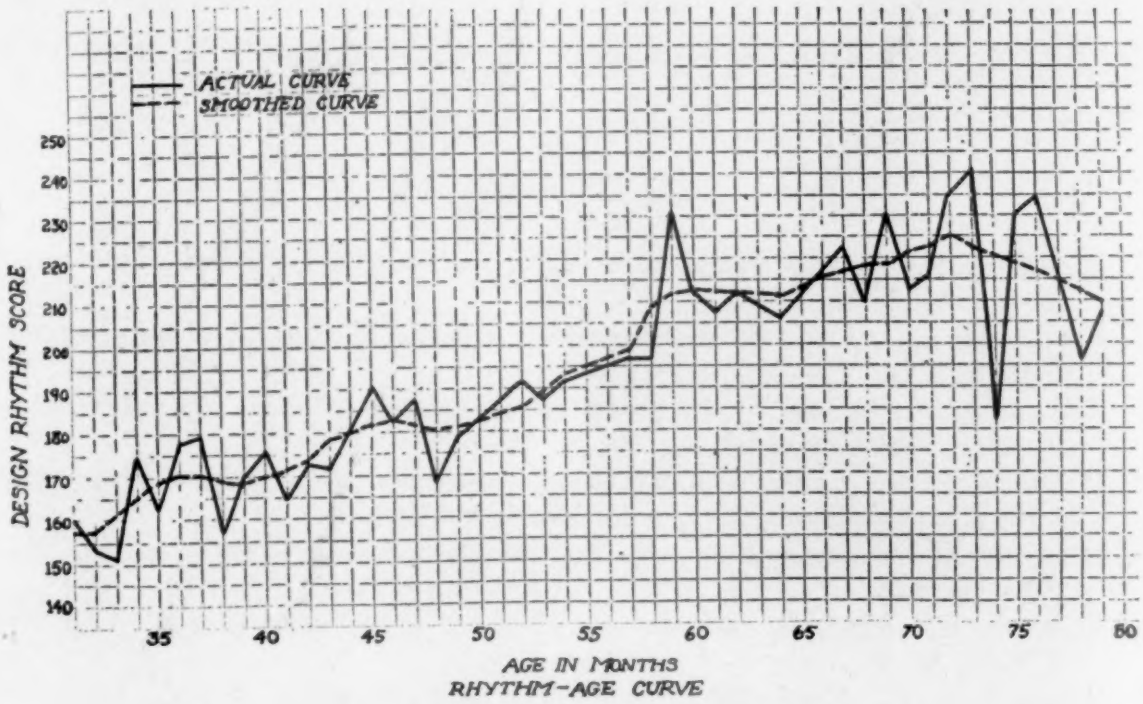

FIG. 5

Design Rhythm Age Curve was plotted to bear this out (Fig. 5) and disclosed a definite acceleration up to the 59th month. To localize the effect of age the subjects were divided into two age-groups. The correlation with the lower age-group (31–54 mos.) was .14±098 (N=45); and with the higher age group (55–79 mos.) it was .29±.08 (N=67). These correlations are not significantly high but indicate some relationship. In Fig. 5 the drop

of the curve at 74 mos. is attributable to one case with a low score. Additional cases would undoubtedly smooth out the curve and maintain the level established earlier.

The correlation of rhythm of design and intelligence as measured by the *Stanford Binet* and *Kuhlmann* tests was found to be .04±.067 which indicates practically no positive relationship. This is in line with the findings of *Daniels* (4) with compositional balance and of *Williams* (24) who secured an r of only .09 between intelligence and rhythm of tapping.

A partial correlation, holding age constant, of .04±.065 between rhythm of design and rhythm of tapping indicates practically no relationship between the appreciation of two-dimensional rhythm of design and the ability to make a rhythmic motor response to an auditory stimulus.

Sex-differences are negligible, the average score for girls being 200.8, for boys 201.7—a difference of .9 in favor of the boys.

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AN EXPERIMENTAL INVESTIGATION OF THE SENSITIVITY OF CHILDREN TO COMPOSITIONAL UNITY [1].

by

KATHERINE SNOW WHORLEY

I. Introduction. The purpose of this study was two-fold: (1) to develop tests which would measure the sensitivity of the pre-school child to compositional unity as evidenced by his ability to arrange three-dimensional objects into a unified group, and (2) to study the relation of unity-sensitivity to individual differences of chronological age, mental age, and sex. It was necessary also in the development of the tests to construct scoring scales, to test for reliability, and to standardize methods of procedure.

This study is classified as one dealing with the nature of æsthetic intelligence as it exists at the age level of three to seven years and is part of a program in which the principles of balance, rhythm, and color harmony have been studied by other investigators. *Daniels* (4), in the first of these studies, concluded that, "appreciation of compositional balance in the child's æsthetic discrimination is evident beyond the possibility of chance in very early years," but has no significant relationship to general intelligence. *Jasper* (11) found that the number of positive responses to rhythm is not significant until the 52nd month, with a rather sudden increase in sensitivity at the beginning of the 59th month. She also found a significant relationship between design-rhythm and chronological age, but no significant relationship with intelligence, nor any sex differences in responses to rhythm. *Walton* (16) in a study of sensitivity to color harmony has shown that ability to select harmonious colors is rare in very

[1] One of a series of five studies of the nature and genesis of artistic talent, under the direction of Dr. Norman C. Meier. Acknowledgment is made to the Iowa Child Welfare Research Station for subjects and financial aid (Spelman Fund).

young children but that this ability increases with age to the age of puberty. It was found, furthermore, that there is little or no relationship between intelligence, sex, and time spent on the test, and sensitivity to color harmony.

In the present study a fourth aspect of æsthetic sensitivity, compositional unity, was investigated. Previous studies in this field indicated the early appearance of unity in children's drawings and paintings.[2] *Eng* (6, pp. 4, 5, 26, 79) found the presence of unity as far back as the scribbling period of a child's drawing development. At 16 mos. some evidence of unity appeared in the "wavy scribbling" and "circular scribbling." In the third year unification of objects appeared in her drawings of situations and real composition occurred in the sixth and seventh years. *Cockrell* (3) found that, "most of the paintings, which were selected to illustrate repetition and balance, also had unity. When a child gets beyond the stage of finding out how brush and paint work, his pictures begin to take on unity." She concluded that, "Repetition, symmetrical and occult balance, and rhythm are found in many of the paintings of these young children. Contrast and unity are just as important and possibly more prevalent, but they are harder to judge."

II. The problem. The main objective of the present study was to measure the sensitivity of the pre-school child to compositional unity which has been defined[3] as, "The just adaptation of the parts to each other, in any system or combination of things intended to form a connected whole; such an agreement between the different parts of a design or composition as to produce unity of effect." Possibly more adequate from the artist's point of view is the definition by *Neuhaus* (14, p. 163), "Harmony (unity) is generally appreciated as the quality in a work of art which makes it appear as if the many component parts were related; as if there existed an affinity of the parts," or *Batchelder's* (1) "Harmony requires that the details of a design shall 'have something in common'." The *Goldsteins* (8) considered unity the "most important of all principles of design"—the result of "the selection and arrangement of con-

[2] No experimental work was found which bore directly upon this problem.
[3] Webster's International Dictionary.

sistent objects and ideas." *Cockrell* (2) interpreted the meaning of this principle as, " That unity which gives the impression that nothing can be added and nothing taken away without interfering with the effect."

Unity may be achieved through the use of rhythm as has been indicated by *Dow* (5), " Rhythmic repetition is a structural principle. Its effect is to unify and simplify the whole composition." Again it may be attained principally through the use of balance. *Langfeld* (12) says, " In describing the unity of pictures, we have almost invariably mentioned a central point of interest and subordinate factors to right and left." *Neuhaus* (14) points out that unity may be created through the use of the principle of emphasis: " absolute sameness in itself can not be recognized as harmony, . . . it must be given emphasis, must be set off by an element of occasional variation or contrast." *Mathias* (13) also mentions subordination as " the means of gaining unity. It is the subdividing of less important parts to emphasize the whole or to accent more important parts," and *Pearce* (15) says that " unity can be achieved by giving one figure the predominance." Closely related to unity is fitness, a resulting attribute of the successful arrangement of the principles of art. Fitness implies suitableness, appropriateness, adaptability to purpose, material, method, tools or environment (*Jackson* 10 and *Whitford Committee* 17).

Unity then is more than a principle. It is one of the resulting attributes of the successful use in a composition of one or more, usually several, principles such as balance, rhythm, emphasis, proportion and repetition, and the minor principles of alternation, sequence, radiation, parallelism, transition, symmetry, and contrast as is indicated in the *Whitford* report (17).

Three principles were selected for the subjects of investigation in the present study: (a) a test for unity involving the principle of *emphasis,* or domination and subordination as the chief constituent, (b) one based upon the unifying function of *balance* (symmetry), and (c) one which involved chiefly the attribute of *fitness.* Each of the tests involved to a lesser degree other principles, such as rhythm, proportion, repetition, *etc.,* as some over-

lapping of principles can hardly be avoided. They can be completely isolated only in extremely simple situations.

III. Technique. After considerable preliminary experimentation, the following test materials were decided upon:

Test 1 (BB). A bird-bath and four evergreen trees (of different sizes) suggesting pyramidal arbor vitae, Colorado blue spruce, mugho pine, and red cedar were modeled from Plastilina.[4] Three sets of these three-dimensional figures[5] were

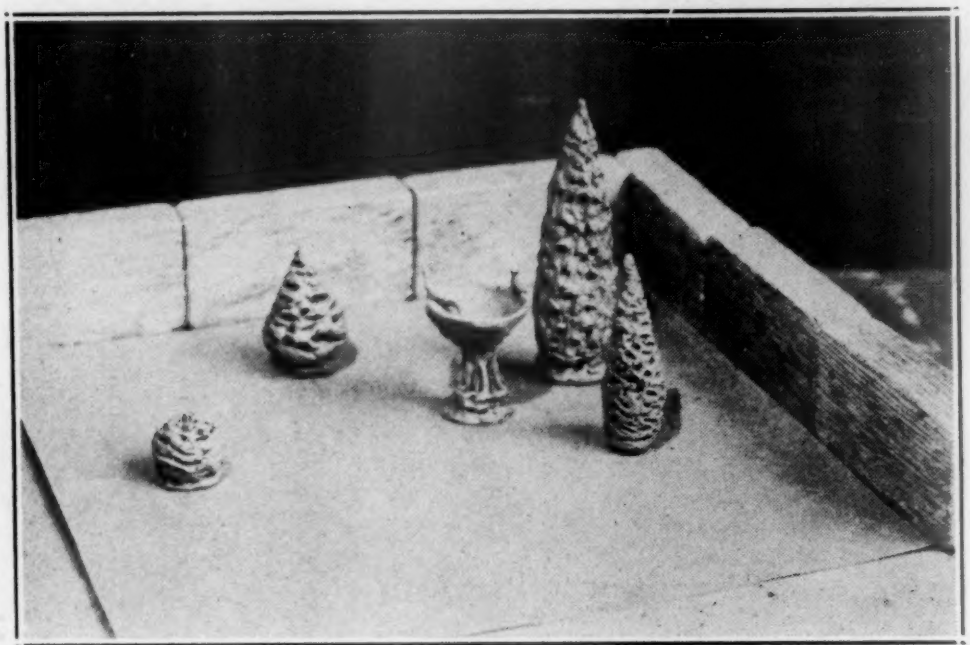

FIG. 1. Test BB

made; two were set up as models for the child on separate 11 in. x 11½ in. sheets of green construction paper, to represent grass plots, enclosed at back and right side by a wall of natural color wooden blocks, 4 in. x 2 in. x 1 in. One model was a unified arrangement, the other not unified. It was thought that these would introduce the child to the general problem without prejudicing him, the instructions reducing the possibility of error in this direction. This technique was especially valuable in securing results which were comparable and at the same time

[4] Plastilina was found to be especially adaptable for the purposes of this experiment, being superior to ordinary modelling clay in color, consistency, plasticity, and general adaptability. That used in this work was obtained from F. Weber & Co., St. Louis, Mo.

[5] Photographs and stereoscopic slides were found to be inferior to the actual materials and the semi-play situation set up for the child.

valid (see results of tests with and without model). The third set was given to the child to arrange as he wished on a sheet of green paper, identical in size with those used in the other arrangements and enclosed on two sides by a wooden block wall (Fig. 1), the bird-bath being fixed in position, the trees being introduced to the subject in random order.

Test 2 (EP). Eight trees (4 sizes in pairs) of Plastilina were modeled and a symmetrical entrance or doorway permanently

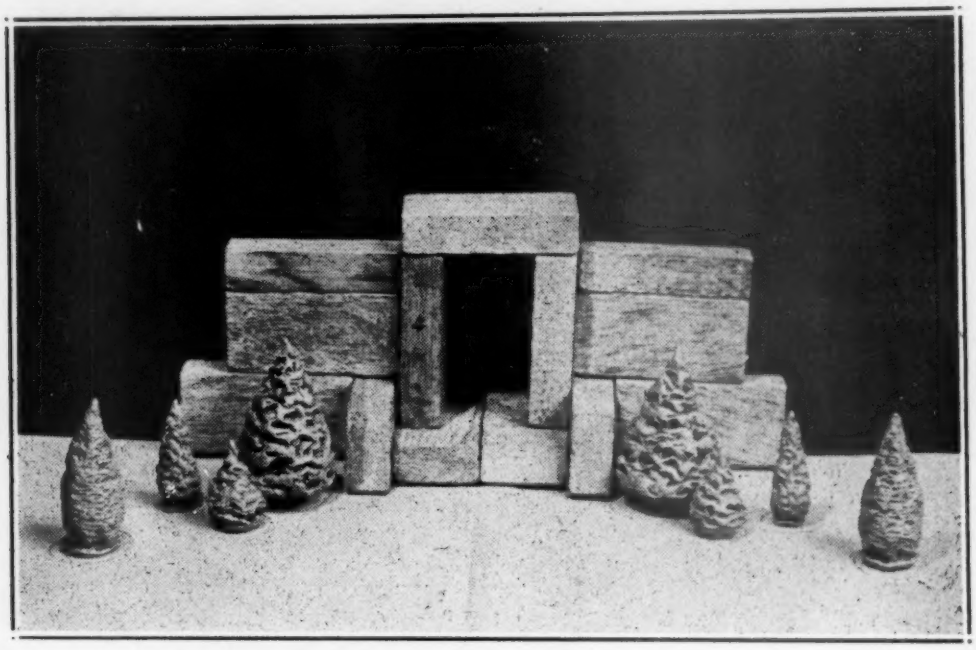

FIG. 2. Test EP

constructed of wooden blocks (two sizes, 4 in. x 2 in. x 1 in. and 4 in. x 1 in. x 1 in.). This building was placed at center back of a sheet of green construction paper, 11 in. x 23 in., to represent grass, and the child was given the four pairs of trees to arrange on the grass plot in relation to the entrance.[6] This was known as the entrance planting experiment (Fig. 2, EP).

Test 3. A cardboard Jack-Bilt Doll House, No. 2,[7] 15 in. x 7½ in. x 11 in., was secured with the back walls of the two rooms cut away to allow insertion of furniture—the room arrangement experiment (RA). Two complete sets of painted metal Tootsie-

[6] It was found that too many elements in the situation resulted in confusion for the child.

[7] Gould & Co., 700–708 West Lake St., Chicago, Ill.

Toy Doll Furniture[8] in suitable proportions for the house were secured to furnish a living room (LR) and music room (MR). For the first, a blue and green davenport, easy chair, ottoman, end table, library table, and blue bridge lamp were provided; for the latter, a red grand piano, bench, rose easy chair, ottoman, gold end table, walnut radio, and rose bridge lamp.

One hundred unselected children, 40 from the Pre-School Group III, 29 from the Junior Primary and 31 from the Elementary School Grade I, ranging in age from three years, six months, to seven years, six months, were used as subjects.[9] Of these, 51 were boys and 49 were girls. Because of limited time, removal from school, lack of co-operation or failure to follow directions, not all of the 100 children were able to take all three tests. Fifty unselected adults from the University summer school classes in elementary and social psychology, ranging in age from 17 to 51 years, were given tests BB and EP. Twenty-five were given test BB with the two models which had been used in testing the children before them, to study the effect upon the test results, and the remainder without the models.

When the child was brought to the testing room, he was asked to sit at the table before the set-up in test BB. The experimenter then pointed to the two models in turn, saying to the child, " See, here are my two gardens. This is one kind and this is another kind. I'm going to let you make a garden, too. Put these trees (indicated by pointing to them) into the garden, wherever you like, but do not move the bird-bath." The child's problem (unstated) was to achieve unity by relating the trees to the bird-bath, corner and wall, a situation in which the principle of domination or emphasis might operate.

As soon as the garden had been completed it was moved to one side to make room for test EP, entrance planting. A double sheet of green construction paper, 11 in. x 23 in., was placed in front of the child with the block-constructed entrance or doorway placed at center back. The experimenter then said to the child, " Here is a doorway that needs some trees around it. Here are

[8] Gould & Co., Living room No. 6725, music room No. 6727.

[9] Acknowledgment is made to the administrators of these groups for their co-operation.

some little trees for you to put around it." Four pairs of trees were placed near the child, outside the green plot. The problem for the child (unstated) was to relate the trees to the building. In this test the child had no models from which to work.

Test 3, room arrangement (RA), dealt with unity in interior arrangement involving the attribute of fitness. The doll house was placed before the child with the cut-away side facing him. The furniture for the music room was given to the child with the instructions, " Here is a house which needs some furniture in it. Here is the furniture for you to put in this room." The right-hand room was indicated. When the child had arranged the furniture, he was given the furniture for the living room, "'Here is the furniture for this room." The left-hand room was indicated. The furniture was always placed on the table beside the house so that the child could reach it easily.

Permanent records of the results were obtained by tracing around the base of each tree in tests BB and EP, and numbering the circles from one to four in descending order of size, *i.e.*, No. 1 was the tallest tree, No. 2 the next tallest, *etc.* The base of the bird-bath and outlines of wall in test BB and the outline of the entrance in test EP were indicated on the paper. The child's name, group number, date and time of testing, were written on the backs of these green papers, which were then filed away. The birth dates and IQ ratings, necessary in determining M.A. ratings, were obtained from the pre-school records of the Iowa Child Welfare Research Station.

A floor-plan diagram was made to scale for test RA, for each of the two rooms of the house, showing windows, doors, and fireplace. The outlines of the furniture were drawn in by the experimenter as the children placed them. These, too, were labeled and filed away as a permanent record.

Of the 100 children who were originally given test BB, 51 repeated it. Of the 83 children taking tests EP and RA, 32 repeated these tests. Sixty-three children originally took all three of the tests; of these 30 repeated them. The interval was from three to nine months.

IV. Results. When about two-thirds of the subjects had been tested providing data that was representative, 14 arrangements each were selected from the records of tests BB and EP representing seven values or steps ranging from no unity to perfect unity. This preliminary classification was made by two artistically competent [10] persons, who went through the records several times, restoring the arrangements and ranking them into

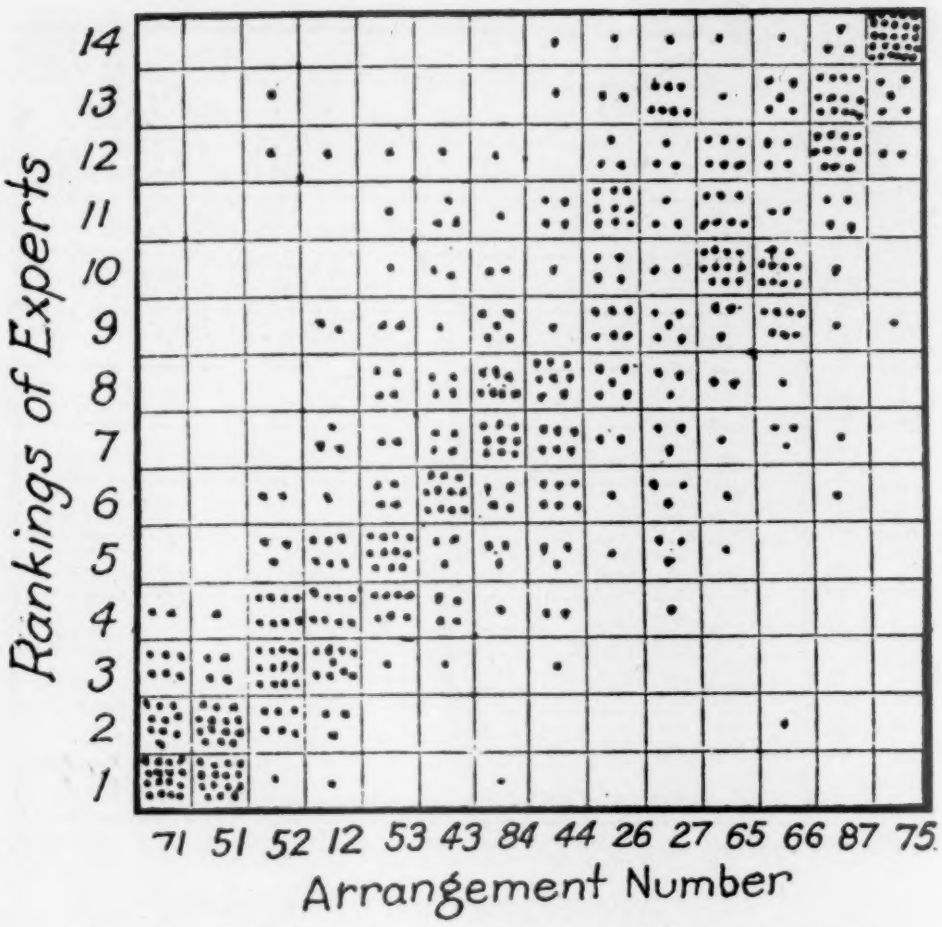

FIG. 3a. Distribution of experts' rankings—Test BB

seven classes. From each of these seven classes they selected two representative arrangements which were set up and photographed. The 14 photographs in each test were mounted on neutral gray cards, numbered on the back in code, and sent to 34 members of the American Society of Landscape Architects[11] with the request that they be arranged in order of their merit.

[10] As shown by scores made on *Lewerenz, McAdory* and *Meier-Seashore* Art Tests.

[11] The writer is indebted to this organization for the excellent co-operation of its members, there being a 100 per cent response to requests made through personal letters by Professor Meier.

These were plotted in Figs. 3a and 3b, and the final scale made up on a basis of the median values for each photograph. The distribution of the plotted ranks shows a close agreement among the judges. To get an estimate of just how close this agreement might be the landscape architects were divided into two groups by chance arrangement and the medians of each item for one group compared with those of another group by Spearman's

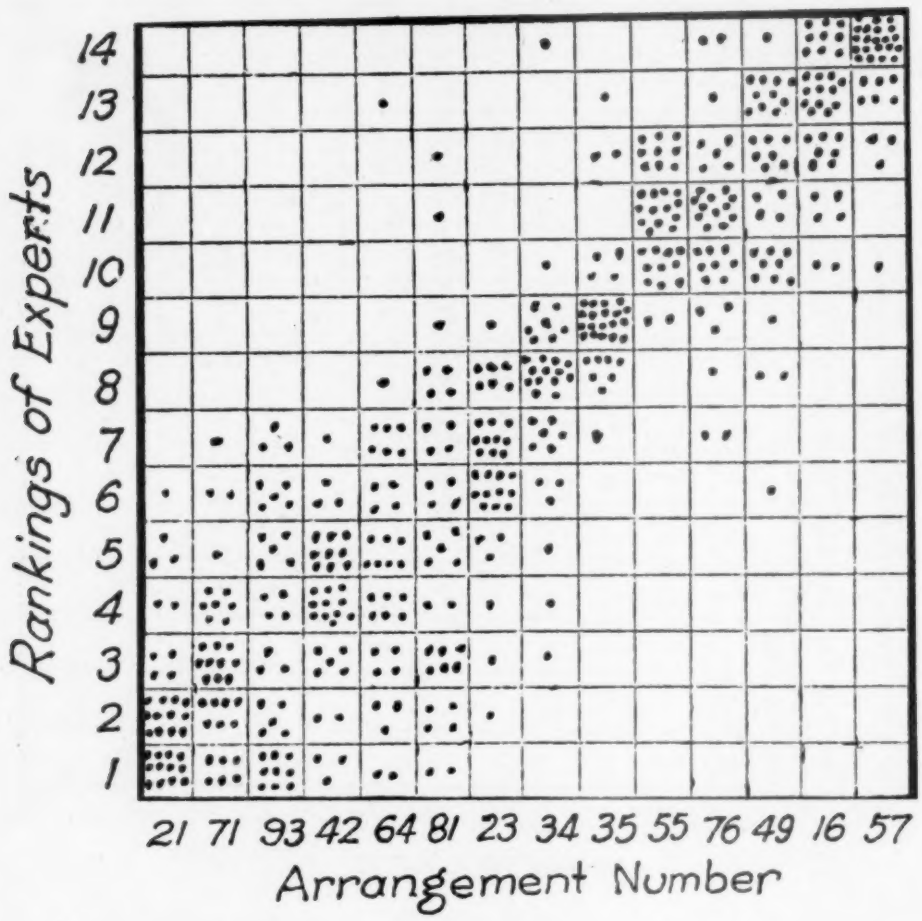

FIG. 3b. Distribution of experts' rankings—Test EP

method of gains. This procedure yielded the surprisingly high correlations of .975 for the Bird-Bath Test and .915 for the Entrance Planting Test. When finally assembled, the steps of the scales were arranged as is shown in Table I.

It was assumed that scale values one and two represented perfect unity, three and four approximate unity, and five, six, and seven lack of unity. The pair having the same scale value were considered to be two representative arrangements of equal value. Any child's arrangement which was similar to any of the first

four pairs was considered as possessing unity of a certain degree. The seven pairs of arrangements which constitute the scoring scale for tests BB and EP are shown in Plates I and II. Records for the test were scored by using the scales and assigning the rank to which the arrangement to be scored most nearly approximated. Test RA was scored individually by three different judges on a basis of from zero to ten points in each of the two situations. From one to five points were given for general effect relative to unity and one point each for the logical placement of the five furniture units in each situation. Scores of zero to three inclusive were taken to indicate lack of unity; four to seven, inclusive, approximate unity; and eight to ten, perfect unity. In Table II the summarized results of the children appear in terms of per cent which are sensitive to unity in the three test situations.

TABLE I. *Order of value of units in tests BB and EP*

Scale value	Test BB		Test EP	
	A	B	A	B
1	71	71	21	21
	51	51	81	72
2	12	52	72	93
	52	12	42	42
3	53	53	93	64
	43	43	23	81
4	84	84	34	23
	44	44	64	34
5	65	27	35	35
	75	26	55	76
6	26	66	16	55
	66	65	76	47
7	27	87	47	16
	87	75	57	57

A—Arrangement by two artistically competent persons
B—Arrangement by thirty-four prominent landscape architects

TABLE II. *Summarized data—children*

Age in years	Test BB			Test EP			Test RA				
	N^1	N^2	%	N^1	N^2	%	N^1	N^2_a	%	N^2_b	%
4	16	7	44	16	4	25	10	3	30	4	40
5	41	16	39	41	17	41	28	15	54	23	82
6	24	7	29	15	9	60	19	16	84	17	89
7	29	15	53	21	15	71	6	5	83	6	100
8	19	16	84	19	17	89					
9	19	15	79	19	18	95					
10	5	5	100	5	5	100					

N^1 = *Total no. of children tested for each age level*
N^2 = *No. of children whose arrangements showed approximate or perfect unity*

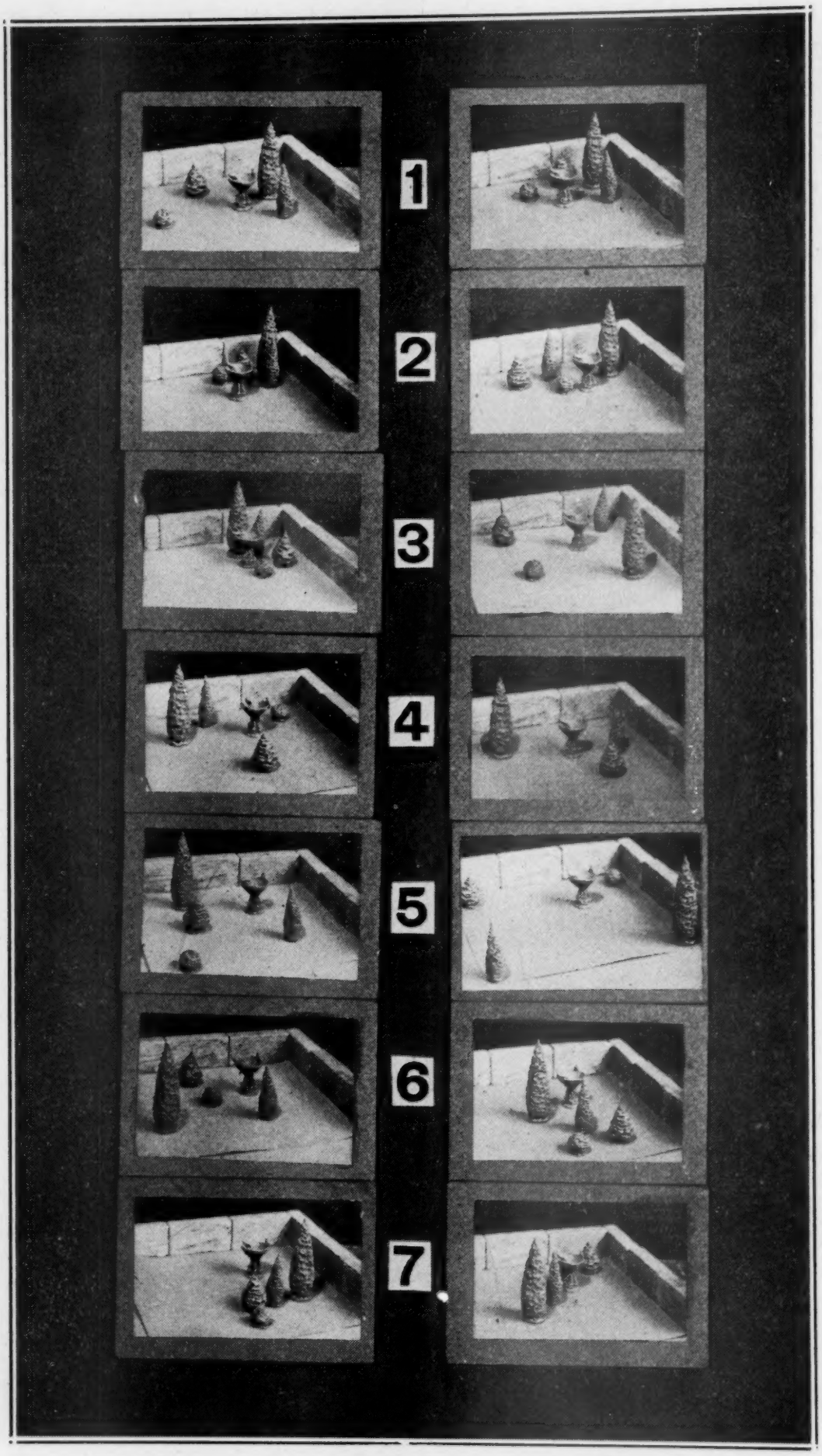

PLATE I. Unity scale, Bird-bath arrangement

PLATE II. Unity scale, Entrance planting

TABLE III. *Summarized data—adults*

Age groups	Test BB			Test EP		
	N^1	N^2	%	N^1	N^2	%
17–21	15	15	100	15	15	100
22–26*	13	10	77	13	10	77
27–31	9	6	67	9	5	56
32–36	7	7	100	7	7	100
37–41	2	2	100	2	2	100
42–51	4	4	100	4	4	100
Totals	50	44	88	50	43	89

* The lower percentages for ages 22 to 31 are possibly due to sampling errors, yet this seems to be consistent for both tests.

Table III shows the summarized results of the tests which were given to the adult groups, half of whom took the tests with models present and half without. There was such close agreement between the results of the adult groups, so tested, that we may safely say that the presence of models is not necessary.

To establish the reliability of the tests the contingency method[12] was used, because the data in this case fall naturally into classes or categories. A 3 x 3-fold classification was considered the most convenient: unity (scores 1, 2), approximate unity (scores 3, 4) and lack of unity (scores 5, 6, 7). The coefficient of mean square contingency, 6, may be found from the formula (7, p. 198) $C=\sqrt{\frac{S-N}{S}}$. Application of this method gave the following results:

Comparison	C	Highest possible C	Probable r equivalent[13]	P.E.
Tests BB and EP (79 subjects)	.52	.816	.64	±.04
Test BB repeated (51 subjects)	.35	.816	.43	±.08
Test EP repeated (32 subjects)	.54	.816	.66	±.07
Test RA, LR with MR (63 subjects	.54	.816	.66	±.04
Test RA, MR repeated (30 subjects	.51	.816	.63	±.07
Test RA, LR repeated (30 subjects	.71	.816	.87	±.03
Tests BB and RA (59 subjects)	.24	.816	.29	±.08
Tests EP and RA (60 subjects)	.37	.816	.45	±.06

[12] Developed by *Pearson* and discussed in *Yule, G. U.* An introduction to the theory of statistics. London, C. Griffin & Co., 1919, p. 64.

[13] After Kelley, T. L., Statistical Method. N. Y., Macmillan, 1924, p. 266.

The figures under C indicate the degree to which there is a relationship between the two elements compared, the nearer C approaches .816, the more closely are the results of one test related to those of the other.

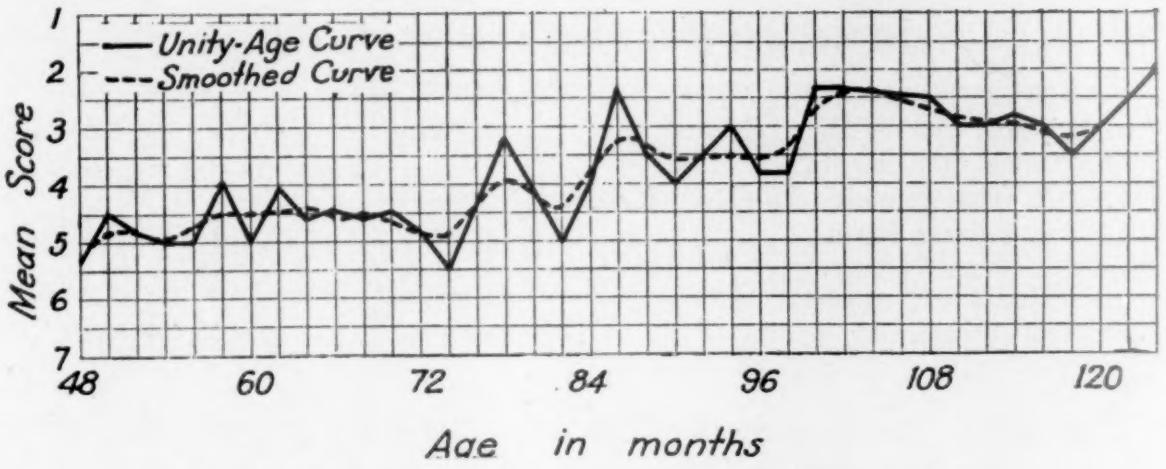

FIG. 4. Unity-Age curve—Tests BB and EP combined

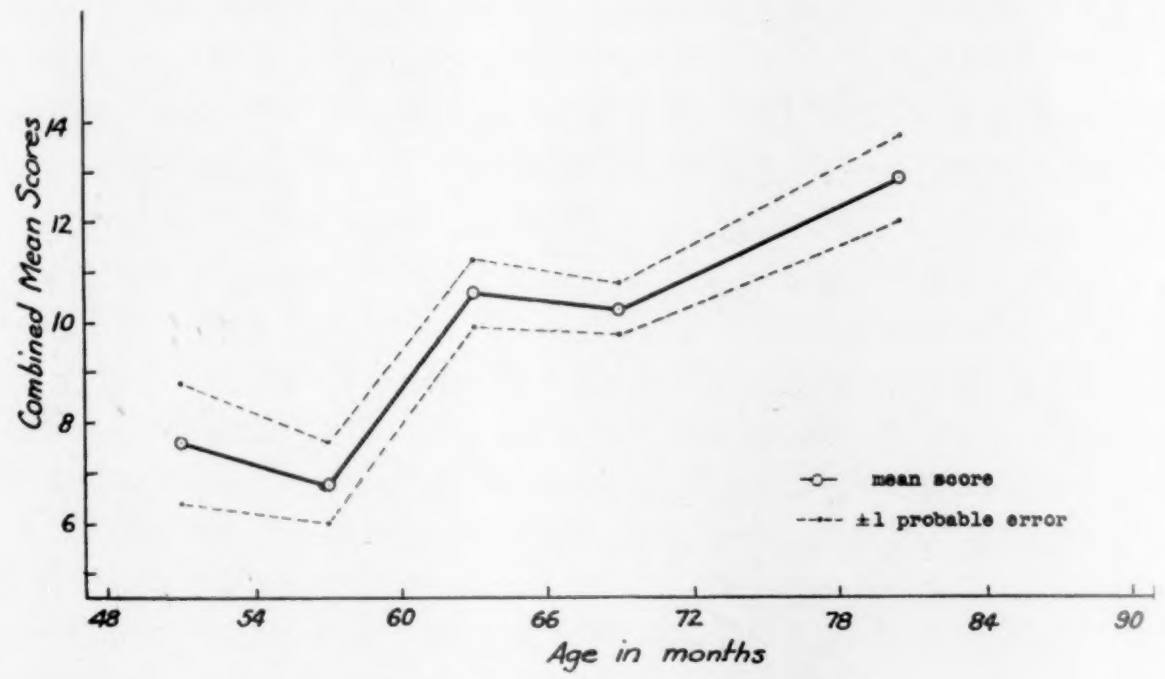

FIG. 5. Unity-Age curve—Test RA

To determine the relationship between unity-sensitivity and chronological age the children were divided into age-groups of six-month intervals, the mean or average score computed for each group, and a graph prepared showing these average scores and their probable errors (2-month interval is used in graph for

BB–EP curve). The results (shown in Tables IV, V, and Figs. 4, 5) indicate that there is a slight increase in unity-sensitivity with increase in chronological age, though this does not hold for adults nor for individuals and for Test EP.

Correlations between chronological age and scores made on the various tests yielded the following results:

Bird-bath test (BB) children	r = .33	P.E. = ±.04
Entrance planting (EP) children	r = .10	P.E. = ±.05
Room arrangement test (RA) children		
1. Living room	r = .36	P.E. = ±.07
2. Music room	r = .42	P.E. = ±.07
Bird-bath test, adults	r = —.01	P.E. = ±.09
Entrance planting, adults	r = —.12	P.E. = ±.09

The adult group was divided into five-year groups and their results treated as those of the children. Apparently there was little or no increase in unity-sensitivity within the age-range of 17 to 51 years. The fluctuation among the different age-groups (Table V and Fig. 6) is due probably to sampling errors. It is reasonable to expect that in a large sample the curve for adults within this age-range would be relatively flat in appearance.

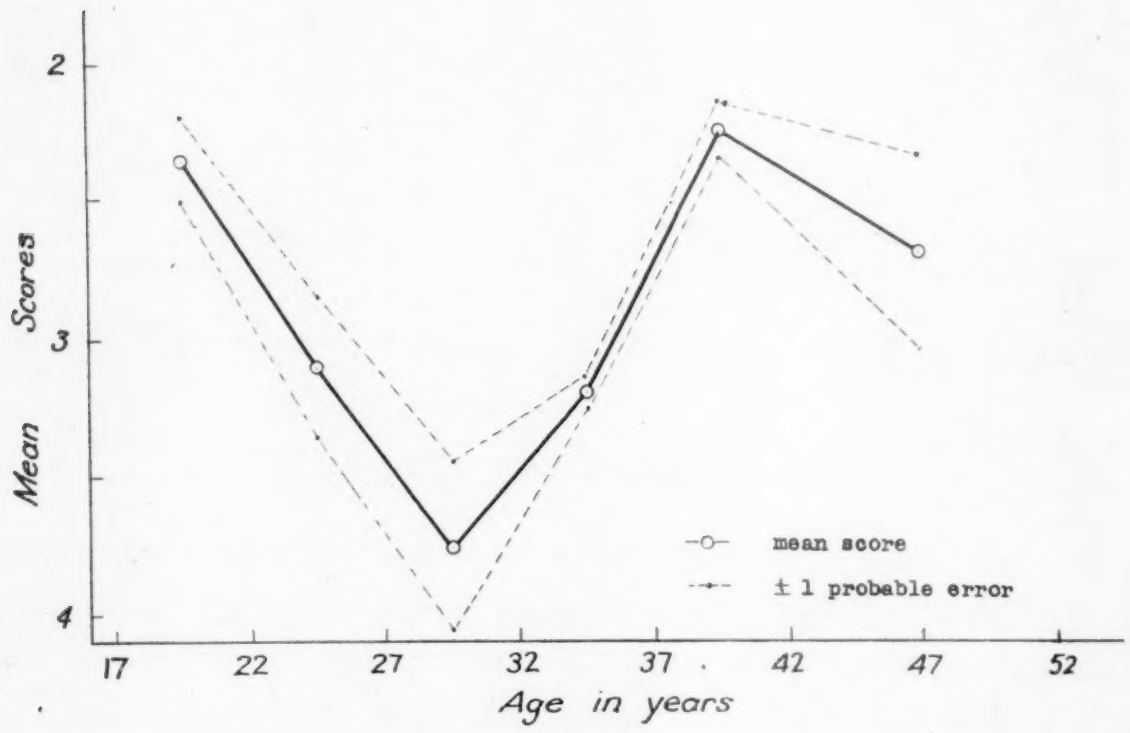

FIG. 6. Unity-Age curve, Adults—Tests BB and EP combined

It is interesting to note that the mean scores for the adult group are considerably higher than for the children's scores. This probably means that there is a gradual increase in the ability of children to sense unity up to the age of puberty, after which, if increase does occur, it is very gradual. More subjects in each of the age-groups are necessary to verify this statement.

A comparison was made between intelligence and unity-sensitivity by translating the IQ ratings furnished by the *Iowa Child Welfare Research Station* into mental ages and finding the correlation between these and the scores made by the children on these tests. The following figures were obtained:

Bird-bath (BB)	r= .05	P.E.=±.06
Entrance planting (EP)	r=−.13	P.E.=±.07

The conclusion follows that there is no relationship between a child's sense of unity and his mental age as measured by these tests. No intelligence ratings were available for the adult groups.

The relation of unity-sensitivity to sex was determined by grouping the boys and girls (Tests BB, EP) into pairs of approximately the same chronological age. A minus sign (−) was given to the pair if the score of the girl exceeded that of the boy, and a plus sign (+) if the score of the boy exceeded that of the girl. Of the 38 pairs, 23 were given minus signs and 15 plus signs, a difference of 8 in favor of the girls. If it is assumed that sex is independent of unity-sensitivity, we would expect half of the pairs to be minus and half plus, so that there would be no difference in favor of either sex. To determine statistically whether this difference was significant, the standard error of the expected frequency was obtained by the formula (9, pp. 243, 248):

$$\sigma_f = \sqrt{f\left(1-\frac{f}{N}\right.} \quad \text{derived from}$$

$$\sigma_{np} = \sqrt{npq} \qquad \text{by setting}$$

$$p=\frac{f}{N} \text{ and } q=\left(1-\frac{f}{N}\right)$$

The difference between the expected frequency, 19, and the obtained frequency, 23, was divided by the standard error of the frequency and the result referred to Table I in *Garrett,* (7, p. 91).

TABLE IV. *Unity-sensitivity and age (children)*

Age in mo.	Bird-bath Test N	Mean	t[1]	Entrance planting N	Mean	t	Room arrangement Test Age in mo.	N	Mean	P.E.ave.
48–59	33	3.42	4.6310	28	4.93	8.2359	48–53	9	7.58	1.18
60–71	34	4.50	7.0221	34	3.85	6.8328	54–59	10	6.81	.75
72–83	23	5.13	10.9100	8	3.00	1.9019	60–65	18	10.64	.71
84–95	17	3.59	7.4160	14	3.36	3.6607	66–71	18	10.27	.53
96–108	19	2.95	8.7465	19	2.53	8.8047	72–89	7	12.90	.75
109–120	19	2.95	8.1690	19	2.53	10.8082				
121–132	3	2.00	2.8393	3	2.00	2.8393				

N = number of children

[1]t — See Fisher, R. A. Statistical methods for research workers. Edinburgh, Oliver and Boyd, 1928, pp. 104–105.

TABLE V. *Unity-sensitivity and age (adults)*

Age in yrs.	Tests BB, EP (Combined) N	Mean	PE (ave.)
17–21	15	4.7	.28
22–26	13	6.2	.53
27–31	9	7.5	.63
32–36	7	6.4	.07
37–41	2	4.5	.24
42–51	4	5.4	.75

Apparently there are only about 9 chances in 100 that the differance in favor of the girls is significant. The results of test RA treated in the same way indicated that there were only 21 chances in 100 thát there was a difference in favor of the boys.

V. Summary and conclusions. One hundred pre-school children ranging in age from four to seven were tested for ability to arrange three-dimensional objects into a unified group. The experimental materials included three tests, composed of small Plastilina trees of the evergreen type to be arranged in relation to a bird-bath and a corner in test BB, and in relation to a symmetrical entrance in test EP, and small metal doll furniture to be arranged within two rooms of a cardboard doll-house for test RA. A scale of values from one to seven, for classifying the children's results, was developed for each of the tests, BB

and EP, by agreement of a number of expert landscape architects. Fifty adults were later given two of the tests, BB and EP, involving the arrangement of trees, as a check experiment upon the results of the children. The children and half of the adults were given test BB with the presence of two model arrangements, one unified and one ununified, to test the factor of suggestion of a model.

Because of the comparatively low reliability of the test materials, it would be inadvisable to draw absolute conclusions. However, within the limitations set by the experimental data and the test materials, certain indications or trends were evident.

1. While the majority of child subjects showed little or no consistent appreciation of unity in arrangement, a few individuals appeared to be sensitive to unity in a very high degree.

2. Wide individual differences were discovered among children in their sensitivity to compositional unity as measured by the test materials of this study.

3. At the lower ages unity-sensitivity seems to be characterized more by its rarity than by its frequency.

4. There was evidence at the ages four to seven years of a tendency for unity-sensitivity to increase slightly with increase in chronological age. This trend upwards was more apparent in the BB and RA tests.

5. The evidence in favor of a maturation factor was somewhat confirmed by the adult results, which showed that the proportion of adults sensitive to unity is greater than that of children, although the degree of unity achieved by individuals was in no case greater for adults than for children. Here, also, wide individual differences were found. From the ages 17 to 51 years, however, unity-sensitivity appears to be independent of chronological age.

6. Apparently there is no relationship between sensitivity to unity and mental age. This is in agreement with the findings concerning the ability to achieve and appreciate balance and rhythm and those concerning sensitivity to color harmony.

7. The data of this experiment do not prove sex differences in

sensitivity to unity to be significant, but some tendency in favor of girls is indicated.

8. From an informal examination of the data, it seems that the presence of examples or models did not lead to imitation or to influence the arrangement of objects to an important degree, since the average scores for tests with and without models were not significantly different.

9. Since the correlation between the tests involving outdoor arrangement and those involving indoor arrangement was quite small, it is reasonable to assume that fitness, the principal constituent of the room-arrangement test, may involve a different mental function in its creation and appreciation than does unity through balance, rhythm or emphasis. A possible explanation for this difference is the probability that the children may have had more experience or observation in regard to furniture and room-arrangement than in regard to outdoor arrangement either directly in their homes, or through familiarity with toys similar to the materials used in this test. However, from the examination of 19 cases of homes where the room-arrangement had been observed, only one or two cases were found in which there were noticeable similarities between the child's arrangement of test materials and his home-arrangement.

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A TECHNIQUE FOR TESTING COLOR HARMONY SENSITIVITY IN YOUNG CHILDREN [1]

by

EILEEN JACKSON WILLIAMS

I. Introduction. Since an important aspect of graphic art is the use of color in pleasing combinations, the aim of the present study was to devise a technique for testing the capacity in children to recognize color harmony. A test of this nature is based on the assumption that precocity in approximating known standards is indicative of more or less permanent superiority.

Difficulties in making such a test are recognized first in finding a criterion of harmony, for which two sources are available. One is to choose colors by principles as laid down, *e.g.,* in Chevreul, Ward, Baker, Luckiesh, or Sargent. The other is to employ the personal judgment of persons who are gifted and trained in art, particularly in the use of color. It is obvious that the use of either or both of such methods leaves room for criticism. Since the work, however, is with young children, it was thought possible to use the simplest form of color harmony, the modified complementary, with two colors, and to avoid the subtler and more complex harmonies which depend to a considerable degree on personal taste and manipulation and the circumstances under which they are used.

A brief preliminary experiment indicated that children of four and five years of age do not seem to discriminate as fine differences between colors as do adults. While conclusive data on this point are lacking, it seemed unsafe to ignore even this indication. Hence the number of colors available for use in forming harmonies was definitely limited, *i.e.,* with a complementary relationship assumed, only a certain number of binary combinations

[1] This study was aided by financial co-operation of the Iowa Child Welfare Research Station. The author is also indebted to Dr. Eva May Luse for permission to apply the technique to children at the Iowa State Teachers College Elementary School.

could be formed from the color circle without making the component colors so similar that the child would not perceive any difference, thus making the apparent quantification in reality fallacious. A time limit was also placed on tests by the short attentive span of young children.

II. Test construction. After a small amount of experimentation several methods were discarded because of obvious weaknesses. Only one of these, which was tried out on 35 children, is described.

Four flowers made from Milton Bradley colored paper were placed in a row and a paper butterfly of a color, which harmonized well with one of the flowers but poorly with all the others, was given to the child with instructions to try it on each flower and place it where it looked the prettiest. Most of the Milton Bradley papers, however, show colors of rather low saturation, one of the conditions which permit colors otherwise inharmonious to be successfully combined. The small number of hues available had already limited the number of possible test-situations and the difficulty of finding really poor combinations made many of the chosen situations doubtful. The theoretically "good" harmony was so little better than the others that there was little agreement even among trained adults and the results could not be definitely interpreted. The method which was used during the greater part of the experimentation was an adaptation of the doll dressing technique used by *Monroe*[2] and others.

A large number of nine-inch squares of white china silk were dyed, two at a time, in various shades and tints of red, orange, yellow, green, blue, purple and intermediate hues. Twelve pairs of colors were chosen according to the rule of modified complementaries, each of the six main colors being represented four times in its various shades or derivatives, and were identified according to the *Ridgway* system.[3]

One color from each of six pairs was used to dress a small doll and a scarf was made from the other color of the pair.

[2] Monroe, M., The drawings and color preferences of young children. Unpub. thesis, Univ. of Chicago, 1929.

[3] Ridgway, R., Color standards and color nomenclature. Washington, Ridgway, 1912.

Three other scarfs were then made for each doll from colors which formed as poor an effect as possible with the dress color. The child was told to choose from the four scarfs the one which looked the prettiest with the doll's dress. The multiple choice technique was employed chiefly to cut down the probability of right choices through chance. An analysis of incorrect responses might also have shown consistent tendencies on the part of the children to prefer certain less conventional harmonies.

After this series was completed, the other six pairs of colors were used in the same way. The division into two sets was made to prevent boredom or fatigue and it appeared from spontaneous comments made by the children that six situations made as long a test as is compatible with good results.

As had been expected, certain of the test items seemed to be better than others. It is quite possible that in a test of color harmony the fact that fewer subjects succeed with an item may mean not that it is harder, but simply that it is poorer, *i.e.*, the good harmony is little or not at all better than the poor combinations, and that a good judge would have no better chance of success than a poor one. It was therefore necessary to use some means to distinguish the better from the poorer situations.

One way considered was to get judgments from art teachers or similarly qualified persons. This required that they be carefully instructed to keep the situation abstract; otherwise their experience in the manipulation of colors would make it difficult for them not to read into a bad combination a third color which would unite them harmoniously.

Another way involved use of children's judgments. Out of six situations involving a four-fold multiple choice, one or two correct responses may easily be arrived at by chance, but if a child scores three or four correct the probabilities are that he has understood the problem. In fact the results on the first form fell into a bimodal distribution, with peaks at one and four. The correct responses of all the children making scores of three or above were counted for each item on the assumption that any item on which the best children did no better than the poor chil-

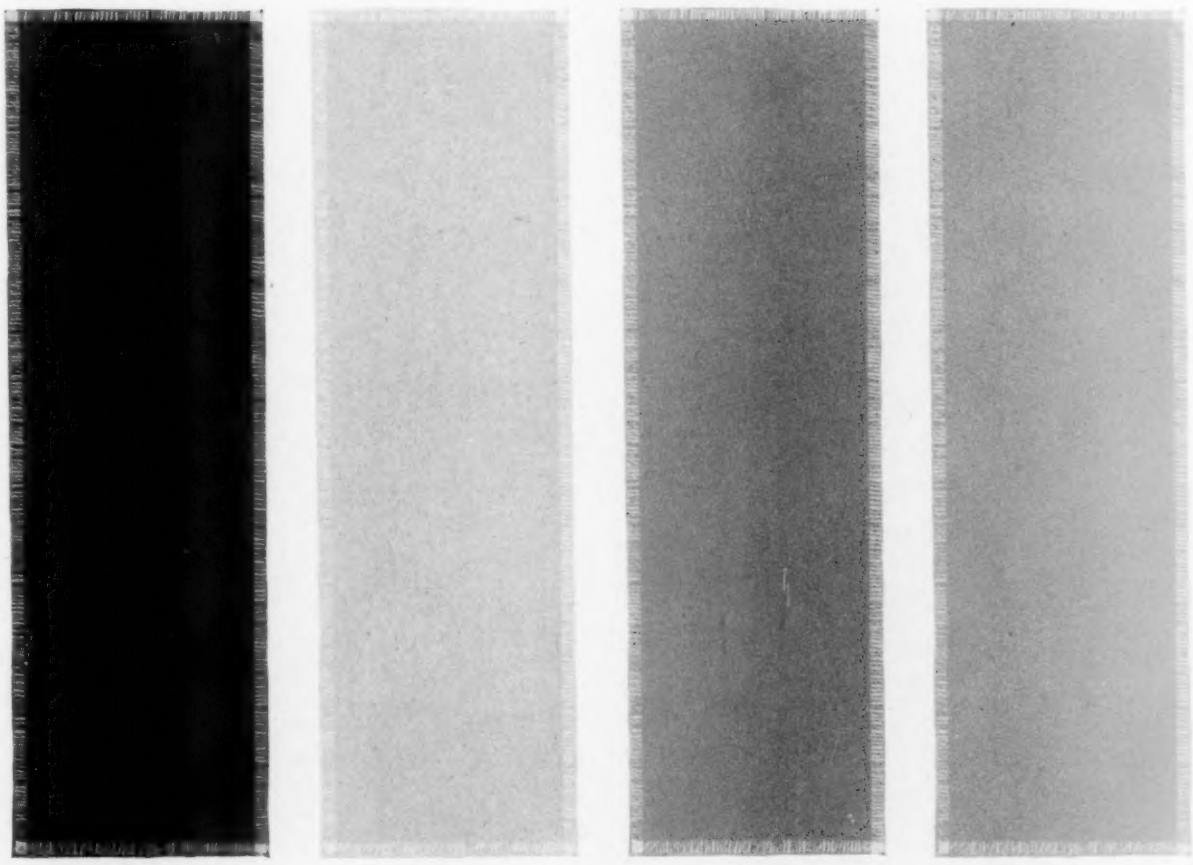

PLATE I

dren was not diagnostic and should be discarded. Two such items appeared in the first form and three less conspicuous ones in the second. Of the remaining items a test of six situations was made, each situation involving the use of one of the six colors (Plate I).

TABLE I. *Color of dress and scarfs*

Situation	Stimuli	Color
1	Dress scarfs	Ox-blood red 1 Blackish violet 2 Paris blue 3 Between apricot buff and apricot orange 4 Hellebore red
2	Dress scarfs	Thulite pink 1 Between spectrum red and carmine 2 Between daphine red and hellebore red 3 Motmot green 4 Orange chrome
3	Dress scarfs	Deep soft blue-violet 1 Gobelin blue 2 Between alice blue and orient blue 3 Prussian blue 4 Rocellin blue
4	Dress scarfs	Apricot orange 1 Light coral red 2 King's blue 3 Carmine 4 Spinel red
5	Dress scarfs	Vanderpoel's blue 1. Alizarin blue 2 Porceline blue 3 Deep colonial buff 4 Blackish violet
6	Dress scarfs	Orange - vinaceous 1 Jay blue 2 Hellebore red 3 Carmine 4 Flame scarlet

III. Subjects. The subjects in this study were 99 normal children from four to six years of age who were enrolled in the Third Group and Junior Primary of the Pre-school Laboratories of the Iowa Child Welfare Research Station, and in the Junior Kindergarten, Senior Kindergarten and First Grade of the Iowa State Teachers College Elementary School (Cedar Falls, Iowa).

IV. Procedure. All the tests were given between 9 and 11:30 A.M. in a small room with northern sky light. The walls were of unpainted white plaster. *E* and the subject sat in front of a small table which was covered with neutral paper (Fig. 1). *E* wore a white uniform, so that the child's own clothing furnished

the only possible source of suggestion in regard to color combinations. Placing one doll and the corresponding tray of scarfs on the table *E* said, " See this doll? She has a pretty new dress and we want her to have a scarf that looks pretty with her dress. Take each one of these scarfs and try it around her neck like this (demonstrating with the scarf at the left side of the box), so you can see how it looks with her dress, and then tell me which scarf you think looks prettiest with her dress." If the child

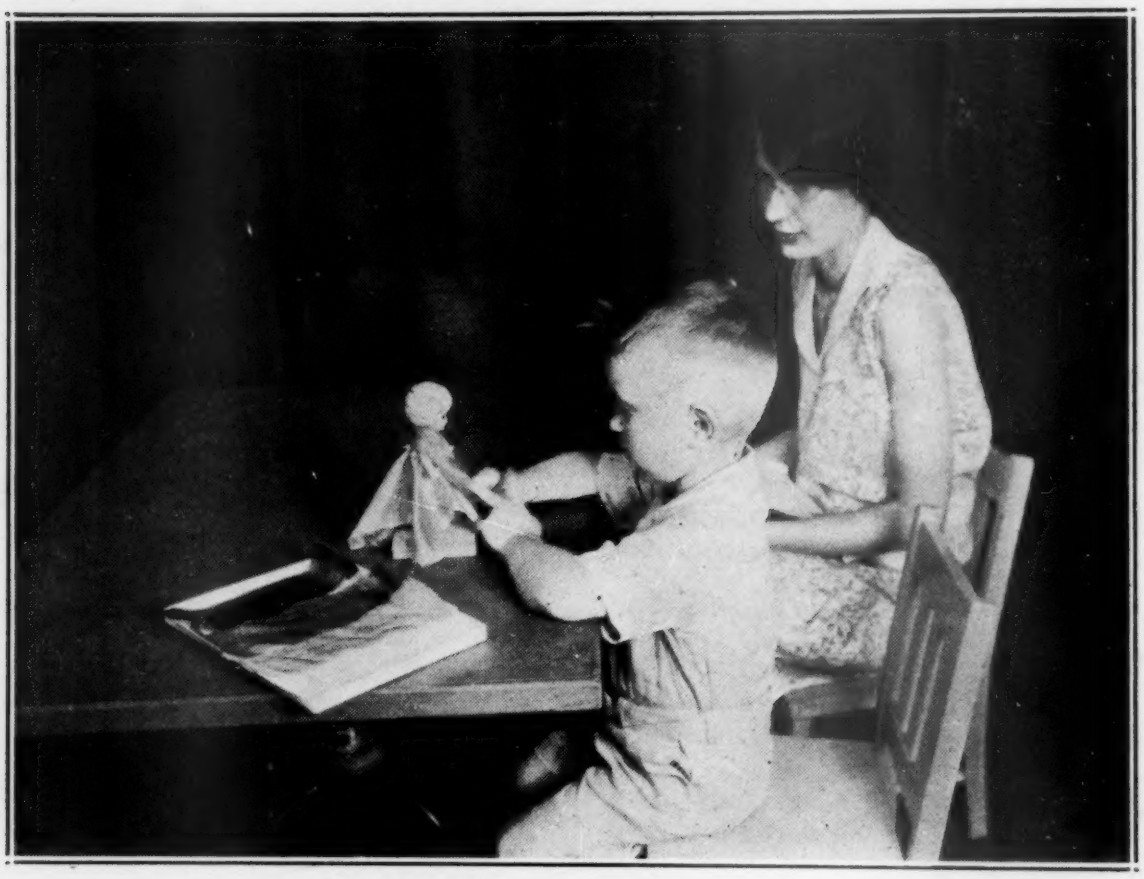

FIG. 1. Experimental situation.

did not seem to understand or failed to try all the scarfs the directions were repeated in part as necessary. When the chosen scarf was placed on the doll, the doll and tray were removed from the child's view and another doll brought out. As each choice was made, *E* recorded as unobtrusively as possible the order in which the scarfs were tried, the final choice, and any remarks made by the child.

V. Results. The data secured in this study are included with Dr. Walton's results in the following article on *Sensitivity of Children and Adults to Color Harmony.*

THE SENSITIVITY OF CHILDREN AND ADULTS TO COLOR HARMONY

by

WILLIAM E. WALTON

I. Introduction. It is commonly thought that in order to be successful every artist must have a good sense of color harmony along with the other capacities and abilities which make up artistic talent. It is natural to suppose, therefore, that in a survey of the artistic capacities and abilities in children there should be included one on the sensitivity to color harmony. While a great number of tests have been made upon the preference and discrimination of colors by children, there have been very few which tested sensitivity to color harmony or any related ability. *Dashiell* (2) studied children's sense of harmonies in colors and tones and found that kindergarten children are indefinite in their preferences for harmonies. Two earlier studies are remotely related to this problem. *Wundt* (8) noted that his two children preferred those combinations which are closely related on the spectrum. *Dobbie* (3) found that 75 children tended to arrange a miscellaneous assortment of colors in spectral order. Numerous studies upon the preference for paired colors have indicated that adults prefer saturated colors in combination and that complementary color combinations are also favored. While these studies may seem unrelated they carry suggestions for the present investigation.

II. Statement of the problem. The purpose of this experiment was to study the Williams technique[1] as a means of measuring the sensitivity to color harmony of children and adults, to discover whether or not children are sensitive to good harmonies, to learn what influence age, intelligence, sex, isolated color preferences and time spent on the test, might have on the score, and to

[1] Reported in the preceding article in this volume.

compare the scores of artistic and non-artistic children. We were also interested in comparing the scores made by the various groups of children with those made by college students and by the average adult.

III. Technique employed in the tests. The writer is indebted to Eileen Jackson Williams who initiated the work in the fall of 1929, prepared the test materials, and tested the first two age groups. Her technique, an adaptation of that developed by *Monroe* (5) and employed by *Arlitt* and *Buckner* (1) in their studies upon the color preferences of children, was followed, with the exception of minor changes, in the present study.

Before discussing the procedure used the question, can young children make discriminations of colors sufficiently fine enough, so that we may be sure that the selected harmonies are harmonies of colors and not ones of light and shade, must be answered. *Holden* and *Bosse* (4) attempted to answer this in a study made in 1900. They found that six-month-old children showed no reaction, seven- and eight-month-old children reacted positively to red, orange and yellow, nine-month-old children included green, blue and violet in the colors to which they reacted, while one-year-old children responded to all colors.

Staples (6) in a recent article has made a similar study under very carefully controlled conditions. Two quotations from her article summarize the findings which bear directly upon the present study, " The sensations of color as distinct from that of gray may be experienced by infants as early as the end of the third month of life," and " the four colors were clearly seen probably by 12 and unquestionably by 15 months and at this age were experienced as distinctly different sensations." The order of effectiveness between the ages of 8 and 24 months corresponds to the findings of *Holden* and *Bosse, i.e.,* red followed by yellow, blue and green in order. It has also been found that if children between the ages of two and a half and four years can understand the instructions and are not color-blind that they can sort accurately the Holmgren woolens. Furthermore, when instructed to make two stacks of colors instead of four, putting all that were alike in one stack and the others in the second stack, the children

placed together the reds and yellows and the blues and greens.[2] Now since children can surely discriminate colors by the second year and since they can make the discriminations called for in the woolens test by the third year, it is unquestionable that they can easily discriminate between colored scarfs by the fourth year. We are safe on that point since the differences are certainly greater than those found in the woolens test.

Studies on the affective value of color combinations when saturation and brightness have been controlled[3] have indicated that direct or modified complementaries are usually preferred over other combinations. This principle was employed by Williams in the construction of the test. Each child, therefore, was confronted with a doll and four scarfs one of which was a modified complementary of the color of the dress which the doll wore. The other three formed a relatively poor effect with the dress. Six situations were presented to the children in the following manner:

The subjects were taken one at a time to a separate room, seated at a table and given a doll and four scarfs with the following instructions: "Here is a doll and four scarfs. I want you to try each scarf upon the doll and tell me which colored scarf you think looks prettiest with the dress." The experimenter demonstrates with several scarfs and then moves the doll and scarfs in front of subject. "Try each one and then tell me which looks prettiest with the dress." Record blanks provided space for personal data, record of choices and remarks made by the subject. Following the test each child was shown a chart of colors made up of samples from each scarf. He was asked to indicate in each group of four which one was preferred.

It was necessary to do the testing between the hours of nine and four in well-lighted rooms. No artificial illumination was used. The subjects were seated so that the light from the

[2] This study is discussed in an article by the writer to appear soon in the *J. Comp. Psychol.*, entitled, "Color vision and color preference in the albino rat, II".

[3] A study has just been completed at the University of Nebraska by *Guilford* on the affective value of combinations of colors when the effect of the three variables has been considered.

windows came from the back and was reflected from the dress. A gray cardboard formed a background for the doll and scarfs. In addition to these precautions, the usual procedure in administering any test was followed. Possible errors in the present technique include a memory error—the memory span for young children may be so short that the pleasure or displeasure experienced with a single combination may be forgotten by the time the last combinations are tried. This was not true in the upper grades and was true only of certain children in the lower grades. The majority of the children of all grades would try the combinations several times before deciding upon them. In some instances they would try several scarfs and then the exclamation of, " Oh, I like that," marked the appearance of a pleasant combination. Usually this scarf was laid to one side until all were tried. The criticism is valid, however, and may be remedied by using a doll for each scarf, presenting the four combinations at once and asking the child to point to the one he likes best. Another error might lie in the effect of the reflected light from the white china silk. A poor combination is enhanced by the sheen of light reflected from the surface. More absorbent material would be better.

Approximately 600 subjects were used in the tests. They came from the *University Elementary School* at the *University of Iowa, Harrison School* at *Cedar Rapids, Iowa,* and *Junior High School, Washington, Iowa.*[4] The adults included students in beginning psychology at the *University of Iowa* and business people of *Cozad, Nebraska.* In these groups variations in age, environment, training, sex, and intelligence made it possible to note the effect of these factors upon the score.

IV. Discussion of the results. When the results from all groups were tabulated it was found that there was a distribution of scores in each group from zero to six, *i.e.*, some children of four made scores of six, while some adults made scores of zero. To learn what factors were responsible, a statistical study was made of the data.

[4] The author is indebted to the administrators of these groups for their interest and co-operation.

Intelligence scores in the form of IQ's were available for 74 of the subjects, ages six to ten, and these were correlated with the scores on the test. It was observed in individual instances that there seemed to be little relationship between the two; the correlation between the IQ's and scores of the group was r=.0009, P.E.±.0806. Another unrelated factor was the time spent upon the test. Casual observation had suggested that perhaps the length of time spent on the test might be related to the score. A correlation of r=.199, P.E.±.077 was the result of this comparison.

A correlation between age in months and the score was r=.39, P.E.±.03 which is significantly high for these data. It is based on the records of 363 children ranging in age from six to thirteen. The average for each of these age-groups is shown in Table II.[5] The median is also given and from both numbers the measure of skewness calculated. Approximately 50 subjects were used in each group.

TABLE II. *Showing median and average scores and degree of skewness for all curves*

Age in Yrs.	Median Score	Ave. Score	σ ave.	S.D.	Sk.*
4	2.03	2.05	.168	1.08	+.05
5	1.58	1.61	.191	1.41	+.06
6	1.53	1.53	.174	1.24	.00
7	1.25	1.52	.181	1.33	+.61
8	1.94	2.26	.239	1.71	+.56
9	1.92	1.98	.182	1.35	+.13
10	2.03	2.27	.231	1.65	+.44
11	2.58	2.70	.226	1.60	+.23
12	2.50	2.80	.225	1.59	+.57
Adult C_z	3.80	3.59	.271	1.65	—.38
Adult Col.	4.03	3.91	.152	1.37	—.26
Children	1.92	2.07	.073	1.54	+.29
Adults	3.98	3.81	.135	1.47	—.35
All Subjects	2.24	2.43	.070	1.68	+.34

* Curve is skewed toward zero end of scale for plus values.

It is of interest to note that the curve in each instance is skewed toward the low end of the scores for the children, and toward the upper end for the adults. The σ ave. and S.D. are also given. From Fig. 1 it is noted that the curve takes a decided drop from the 4th to the 5th yr. This level is maintained at the 6th year

[5] The range of scores is from 0 to 6.

after which it is questionable which direction the curve should take. After the 7th yr. there is a gradual increase until the 11th and 12th yrs.

When the curve is smoothed we find a decrease to the 6th yr. after which there is a steady increase. There are several possible explanations of the higher scores for the 4th and 5th yrs. These particular tests were administered by Mrs. Williams in her preliminary study and while every effort was made to make the technique identical, there may have been some difference in seemingly minor points. This would not explain, however, why there is a

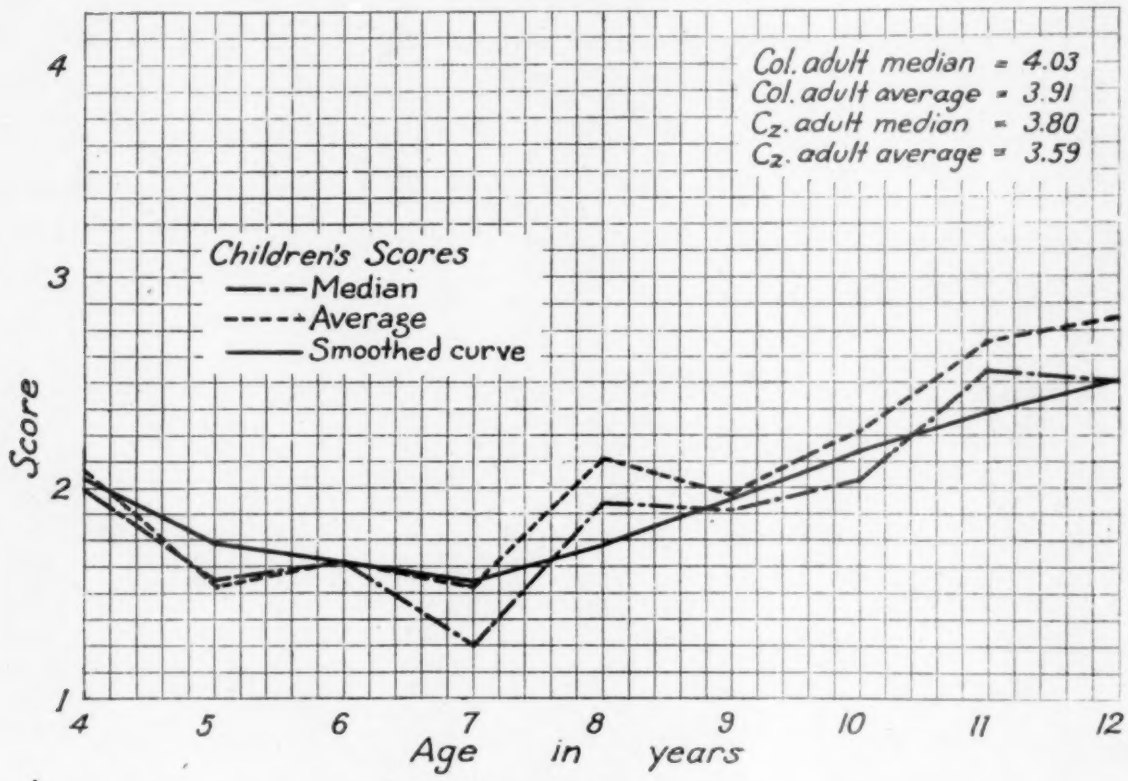

FIG. 1. Color harmony curve.

slight downward tendency to the curve. It is interesting to note that the scores of the college adult and Cozad business groups[6] are considerably higher than the highest average made by the children.

While there is an upward trend to the curve, how significant the trend is, is open to question. By inspection it may be noted that the rise appears to be definite, also that the correlation between age and score is significant. But further evidence may be gained by determining the chances that the difference between

[6] Designated as Col. adult and C_z adult on Fig. 1.

any two averages or points on the curve is a significant difference. These are shown in Table III for the various combinations. The $\sigma_{diff.(ave.)}$ are not significant for ages five and six, six and seven and eleven and twelve; otherwise all the differences between the averages *are* significant. At the ages mentioned above, levels in the curve are reached. It will also be noted that these are adjoining points on the curve; the $\sigma_{diff.(ave.)}$ for all points on the curve which are not contiguous *are* significant.

TABLE III. *Significance of differences on sensitivity curve*

Ages	$\sigma_{diff.(ave.)}$	$\frac{X}{\sigma}$	Chances in 10,000 of diff. > 0
4 and 5	.255	1.725	9577
4 and 6	.244	2.148	9841
4 and 7	.253	2.095	9819
5 and 6	.258	.310	6217
6 and 7*	.256	.039	5156
7 and 8	.304	2.434	9926
7 and 9	.262	1.755	9604
7 and 10	.296	2.534	9944
7 and 11	.294	4.013	9999
7 and 12	.297	4.343	9999
7 and C_z	.330	6.277	9999
7 and Col.	.242	9.876	9999
12 and C_z	.352	2.244	9869
12 and Col.	.271	4.096	9999
8 and 9	.301	.930	8238
9 and 10	.294	.986	8379
10 and 11	.323	1.331	9084
11 and 12	.319	.313	6228
Col. and C_z	.311	1.029	8883
Boys and Girls	.162	3.257	9995

* The $\sigma_{diff.}$ for the median is .320, $\frac{X}{\sigma} = .875$, and the chances of a difference = 8092.

From the evidence just presented it must be concluded that there is a very definite relationship between age and sensitivity to the harmony of colors.

Fig. 2 shows the distribution of scores for children and adults. The frequencies for the adult group have been multiplied by 3.84 to make the two curves comparable. The figure also shows the

skewing of the curves toward the extreme ends of the scale of scores.

At first inspection of the data there seemed to be little difference between the scores made by the girls and those made by the boys. The average of the scores for 176 boys, however, is

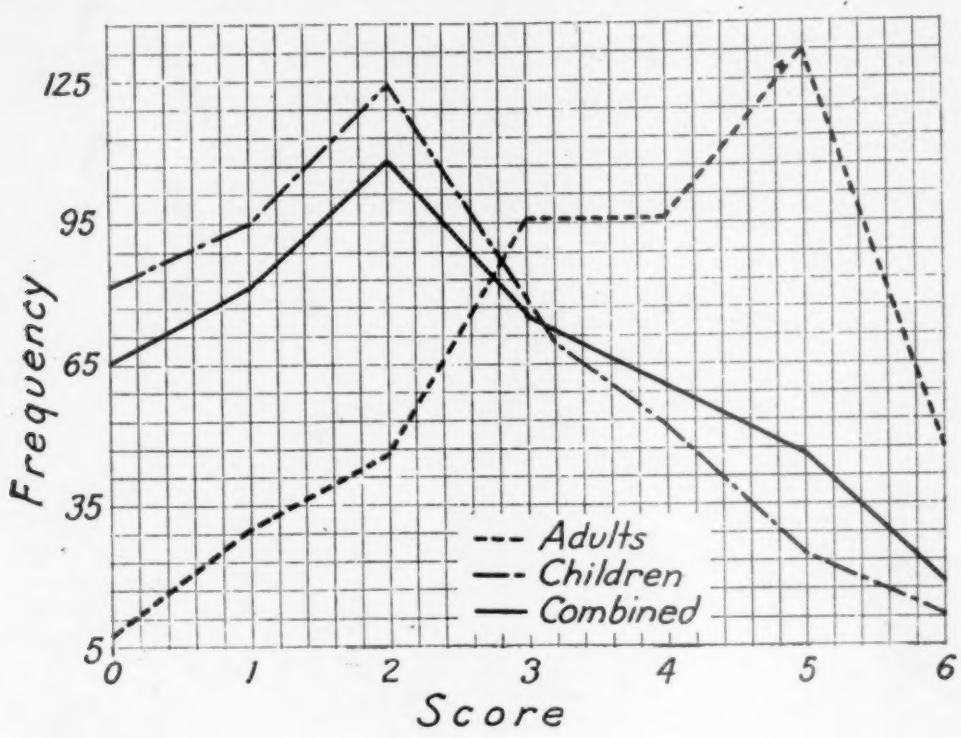

FIG. 2.

1.909 and for 195 girls, 2.436. The chances in 10,000 of a real difference greater than zero is 9,995. The percentages of boys and girls making various scores are given in Table IV. The differences are consistently in favor of the higher scores for the girls and the lower scores for the boys.

TABLE IV. *Per cent making score*

Score	Boys	Girls
0	17.0	15.4
1	23.9	17.9
2	29.0	23.1
3	16.5	14.4
4	9.7	14.9
5	2.8	9.2
6	1.1	5.1

A study of the reliability of the test when repeated for 35 children ages four to six, gave a correlation of r=.66, P.E.±.06. The correlation is high for data obtained under the conditions of

this experiment. The coefficients of contingency were found for each item by comparing the score made by each subject on the first and second trials. These coefficients are shown in Table V. These are high for this type of experiment and indicate that the test is fairly reliable. This conclusion is further substantiated by the σ and the $\sigma_{diff.(ave.)}$ shown in Tables II and III.

TABLE V. *Coefficients of contingency showing reliability of test items*

Situation	C	Highest possible C	Interpreted as r [7]
1	.531	.866	.62
2	.639	.866	.74
3	.474	.866	.55
4	.567	.866	.65
5	.622	.866	.72
6	.522	.866	.60

The original interest in this problem was in part to learn whether or not there is any relationship between artistic ability in children and their sensitivity to color harmony. Among the subjects tested in the *University Elementary School* are seven who by teachers' ratings, various tests which have been devised in this laboratory, and scores made on rating scales of artistic ability, have been selected as having made superior artistic products. If these children receive high scores on the test while those who are decidedly non-artistic receive low scores, it must be concluded that there is some relationship between the two abilities. This comparison (see Table VI) shows that the artistic children's average score was higher. This difference, however,

TABLE VI. *Showing inadequacy of test as one diagnostic of artistic ability*

Age	A[1]	Age	N[2]	Age	H[3]
6	2	6	2	6	4
7	3	6	0	6	6
7	3	7	1	7	5
7	1	7	0	7	5
7	0	7	1	7	5
8	6	8	3	8	6
8	1	8	2	8	5
Ave.	2.28		1.28		5

A[1] Seven artistic children
N[2] Seven non-artistic children
H[3] Seven children making the highest scores

[7] See Kelly, T. L. Statistical method. N. Y., Macmillan, p. 266.

lacks significance because of the fact that the seven highest scores made on the test were made by children who belong to neither of these groups. Furthermore, the scores of the artistic children are not consistently higher than those of the non-artistic group but range from zero to six. For five of the scores made by the artistic group the same scores were made by five of the non-artistic group.

Of these 14 children only one made a score which may be found in the H^3 column. Apparently at the child level there is little relationship between artistic ability and sensitivity to color harmony as measured by this test. This accords with the findings of *Tiebout* (7) on *color sensitivity* of these same children. Using the *Lewerenz* Color Recognition Test, she found that the averages were the same for each group.

It seems reasonable to assume that one color of a pair may play the most important part in determining the selection of that pair, It is possible that the preference for individual colors might determine entirely the preference for combinations in which those colors appeared. To make a test of this, 74 of the children were given a preference test. Strips of cloth, taken from the scarfs, were mounted on a gray cardboard and shown to the children and the preferences compared with the preferences for the good and poor harmonies. By chance alone one out of four should be the same, *i.e.*, 25 per cent of the time the children would select the same colored patch as colored scarf. Tabulations of 474 judgments indicated that 39 per cent of the time the 74 subjects preferred a color also found in the combinations of colors which they had used in " dressing " the doll. This is 14 per cent above a chance agreement. It suggests, however, the possibility that in the selection of harmonious colors, the preference for a single color might have played a small part. Those who made high scores were less affected by their single preferences than those who made average or low scores.

Remarks of children making scores at both extremes were little different. Early in the experiment it was observed that one of the youngest of the subjects was very careful in his selection. From notes the following is taken:

Selects each color combination very carefully; puts inharmonious colors aside with remark, "This wouldn't go well." His score was six. Another child also making a high score volunteered the remark, "This color (orange) has red in it like the dress and wouldn't go well with it." These and similar remarks suggested the possibility that those making high scores were aware of certain factors or principles involved in the selection. Yet any interpretation would be confused by other cases where similar enlightening remarks were made only to be followed by an error. The following remark is a case in point. "This pink is too much like it (red) and won't do", followed by the selection of the orange scarf. An older group when questioned after the test revealed a lack of knowledge of principles of color harmony. A typical answer to the question, "Why did you pick out those?" is the following response, "Oh, I don't know." "I just like them better." Few children making high scores gave any definite indication that they were following principles of color harmony. In the records these could be matched by those making low scores who from their remarks seemed to understand them but in avoiding one combination in obedience to these principles selected another which was contrary to them.

V. Summary and conclusions. Approximately 600 children and adults were given a test designed to measure their sensitivity to color harmony. A statistical study was made of the influence of age, intelligence, sex, isolated color preferences and time spent on the test. The data thus obtained have led to the following conclusions:

(1) Sensitivity to color harmony may be found in individual children as early as the fourth year. Averages for the groups, however, are not above a chance score until after the eighth year.

(2) There is a very definite relationship between age and the score made by the group. By the 12th year children have not reached the adult ability, though a "leveling-off" occurs.

(3) Intelligence, single color preferences and the time spent on the test do not appreciably affect the score.

(4) Our studies indicate that artistic children do little better on the test than unselected children but better than non-artistic children.

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A STUDY OF CREATIVE ARTISTIC IMAGINATION IN CHILDREN BY THE CONSTANT CONTACT PROCEDURE [1]

by

VELMA BOOKHART GRIPPEN

I. Introduction. The functioning of creative imagination at the child level presents a less complex situation for study than it does in the adult, yet the mechanism is probably quite similar save on the score of complexity. With the child, whose introspective comments are perhaps of small value, a semi-experimental situation was thought desirable in which free association could be stimulated when the painting act was well under way, and a verbatim record secured of the child's associations and succession of images and ideas. Accordingly a procedure was utilized requiring the subject to draw or paint in an experimental room devoid of pictures or other objects, with only the experimenter and a court-reporter type of stenographer in the background, present. This constant contact provided in that way an opportunity for the child to display the functioning of his æsthetic intelligence and having it recorded in two forms: a graphic record (the painting) and his verbal thinking concomitant with the inception, development, and revision of his imaginative experience (the stenographic record). While not committing one's self on the concept of thought as sub-vocal or vocal speech, the writer adheres to the view, supported by extensive observation, that *in children* of the ages investigated a very large proportion of their thinking is concomitant, if not identical with, their speech.

Since imagination is concerned with past experience, which in the adult is often impossible to trace and to identify, this difficulty was of less consequence in the case of children whose experi-

[1] This study is one of a series of investigations known as Genetic Studies in Artistic Capacity, sponsored by the Carnegie Foundation.

ences go back only a few years. The condition of the study, moreover, presented an exceptional circumstance in this respect, especially in that all the subjects used were the same ones under investigation by other research assistants whose collective information provided the necessary means for a more or less complete and accurate account of the child's background, experiences, and environment including visits and travels.[2] Ready access to homes, parents, teachers, the child's books, playthings, *etc.*, made it possible to follow up items appearing in the verbal records and trace them to their sources. The parents, furthermore, were above the average in type, interested in their children and willing to co-operate. As an aid in interpretation in another way, panoramic Leica Camera studies of the home environment and interiors of the home were available. All of these sources provided means for confirmation, checking and supplementing imperfectly or incompletely known items.

The objectives of this study were therefore (a) to establish the age at which creative imagination begins to function in the child, (b) the variations in two groups of children, the artistically interested and the artistically disinterested, which should by contrast afford considerable insight into the functioning of creative imagination, and (c) the nature of the sources of the child's imagination particularly as this concerns his graphic ideas.

II. Preliminary procedure. The age at which creative imagination begins to function in the child being unknown, initial effort was directed toward the third-year group.[3] *Monroe* found that the great proportion of children's drawing at this age could be classified as "scribble" which she divides into "scribble unnamed" and "scribble named."[4] Each child in the 3 yr. age-group was requested to make at least two drawings, stenographic reports of the proceedings being secured at the same time. At the completion of this series an analysis disclosed that this level is still concerned primarily with the handling of brush or crayon

[2] F. Rodgers, Variation in the æsthetic environment of artistic and non-artistic children.

[3] Home Laboratory of the Iowa Child Welfare Research Station, also referred to herein as "Group II".

[4] Unpublished Ph.D. thesis, Univ. of Chicago, 1929.

with no readily discernible objective. The child's usual reply to questions was evasive or noncommittal and if named the title might presently be forgotten and a new one assigned. This was clearly the scribble stage or what *Eng* (6), *McCarty* (16) and *Mathais* (18) call the manipulative stage. In confirmation of the opinion previously expressed by teachers both the conversation and products of these children gave evidence of a lack of development so great that no child's drawing was greatly dissimilar from any other child's drawing. In view of these findings it was deemed inadvisable to continue at this age-level.

The same procedure was followed in the 4 yr. group,[5] using those children identified as decidedly superior or inferior, and concentrating on 11 children whose products were analyzed. In this group some development was noted, yet the superiority shown by the children adjudged as probably talented was so slight as to discourage further study.

Final procedure. A somewhat different plan was followed with the 5 yr. group. Inasmuch as three other investigators were also interested in securing about 12 children as subjects, half representing the most talented artistically and the other half the least talented out of about 100 children, the selection was made on the basis of the following:

1. Ratings of children by teachers, observers, and others.
2. Scores made on the *Kline-Carey* Scale.[6]
3. Evaluation of 18 exercises in art (in the junior primary grades and in Grades I and II).
4. Evaluation of drawing and painting products.

For convenience and for study of an adequate age-range, it was decided to treat ages 5 to 7 as a unit. Hence the new subjects consisted of four from the junior primary grade (fifth year), four from first grade and four from second grade, two each of talented and untalented at each age. In scoring the children's drawings in the *Kline-Carey* series the drawings were scored independently by four judges whose scores on the *Meier-Seashore* Art Judgment and *McAdory* Art Tests qualified them

[5] Group III, Iowa Child Welfare Research Station.
[6] Kline-Carey, A Measuring Scale for Free Hand Drawing (12).

as competent. The judges' scores were then correlated and the average by the Spearman rank-difference formula found to be .89±.03. All scoring by the judges was made without the identity of the child being known.

Table I gives the final classification of subjects in the main group, symbols being substituted for the actual names. In these symbols X designates artistically talented and Z artistically disinterested.

TABLE I. *Final selection of subjects*

Superior Group	Age at beginning of experiment	Age at end of experiment	IQ
XIB	7–7–4	7–9–16	94
XAM	6–1–14	6–2–26	166
XAP	6–10–2	6–11–14	113
XAJ	5–5–1	5–6–13	131
Inferior Group			
ZAS	7–1–26	7–3–8	113
ZAV	5–4–8	5–5–20	125
ZIW	6–9–12	6–10–24	103
ZAG	6–1–19	6–3–1	109
ZEW	6–6–13	6–7–25	114

Procedure. The child was introduced into the test situation with the customary announcement that he was going to play a game. He was shown the easel which was placed in a position to receive the best lighting. The stenographer was seated in an unobtrusive position in the room and, if any question as to her identity arose, the subject was told that she was a friend writing a letter.

The technique of recording verbatim all conversation between *E* and the child, with the amount of time consumed and significant behavior of the child during the drawing process, was seldom varied. The investigator normally assumed the rôle of spectator, asking questions when they were calculated not to disturb the free and complete drawing act. Whenever *E* desired additional information, the child was questioned. Responses were elicited in a natural manner to discover the source of the idea represented in the drawing, recency of the perceptual experience, and any other information the child might offer. Leading questions were avoided as far as possible.

At the beginning of the test situation the child was given his choice of crayons or water colors.[7] The following instructions were given:

"I want you to make the best drawing you can. You may draw anything you wish. Tell me the story of the picture as you draw it."

No suggestions as to the subjects to be drawn were given except in the instance of the four Kline-Carey Scale items. No aid was given to the child in regard to the mechanics of drawing. The child was allowed to draw as long as he wished; in several cases when he had not completed his production by the close of the school day he was allowed to continue at the next test period. When the drawing was completed, it was filed away with the following data: child's name, date of production, and name given to drawing, if any.

At intervals *E* visited the homes of the subjects, with an aim toward discovering all possible information concerning the drawing. When the source of the graphic presentation was something in the home, *E* asked to see the original so that a comparison might be made.

Results: From the preliminary results it was evident that creative imagination would be found only in exceptional instances below the 5 yr. level. Results with the 5 yr. group (junior primary grade) indicated at an early stage that in subject XAJ creative imagination was not only functioning but functioning as effectively as in any of the older subjects. The X group early differentiated itself from the Z group in extensiveness of imagination, character of material represented, in the amount and character of mental activity accompanying the drawing, and in the degree to which compositional elements entered into the paintings, assuming that memory, and stereotypes make up the typical unimaginative production.

A study of the results in 146 paintings made by the X, Z, and several Y[8] subjects, both in the experimental situation and at

[7] Available to subjects were: 16 x 22 white paper; tempera paints in red, blue, green, yellow, and white; one ⅜ in. water color brush; one ⅝ in. water color brush; one box Copley Crayons (Milton Bradley).

[8] Refers to artistically average subjects.

home, revealed considerable variation in the character of sources and in the working of the child's imaginal processes. These are classifiable into seven groups, some in which creative imagination of a high type was obviously present and some exhibiting little or no imagination of any kind. In some instances the child was able to identify the source of his theme and yet had a composition that was unlike the source. It is principally on this score that creative imagination was in evidence: the child revamped the

FIG. 1. Farm scene (28–23)

memory image or images, added others of a related nature or in any other way put together his own graphic organization in such a manner as to secure æsthetic effectiveness. This variance from the original setting may be in the nature of improvisation which is difficult to explain without the aid of the subject himself, or a study of the subject's access to pictures, books, and other possible source materials. While it is not possible to discuss all the variations occurring in the paintings produced by the children the following includes the greater portion of them. A number of illustrative examples are included.

PLATE I

[a] Palm Trees

[b] Teeter Totter

1. *From a single memory image a revised expression is developed.* This category embraces all the more or less simple compositions which are based upon a single dominant object as the central theme, there being added the usual setting, either from imagination or from directly and immediately-experienced sense impressions. The picture " Palm Trees " (Plate I[a]) by subject YAM was traced to an illustration of a *single* palm tree in the *National Geographic Magazine.* The two other trees were

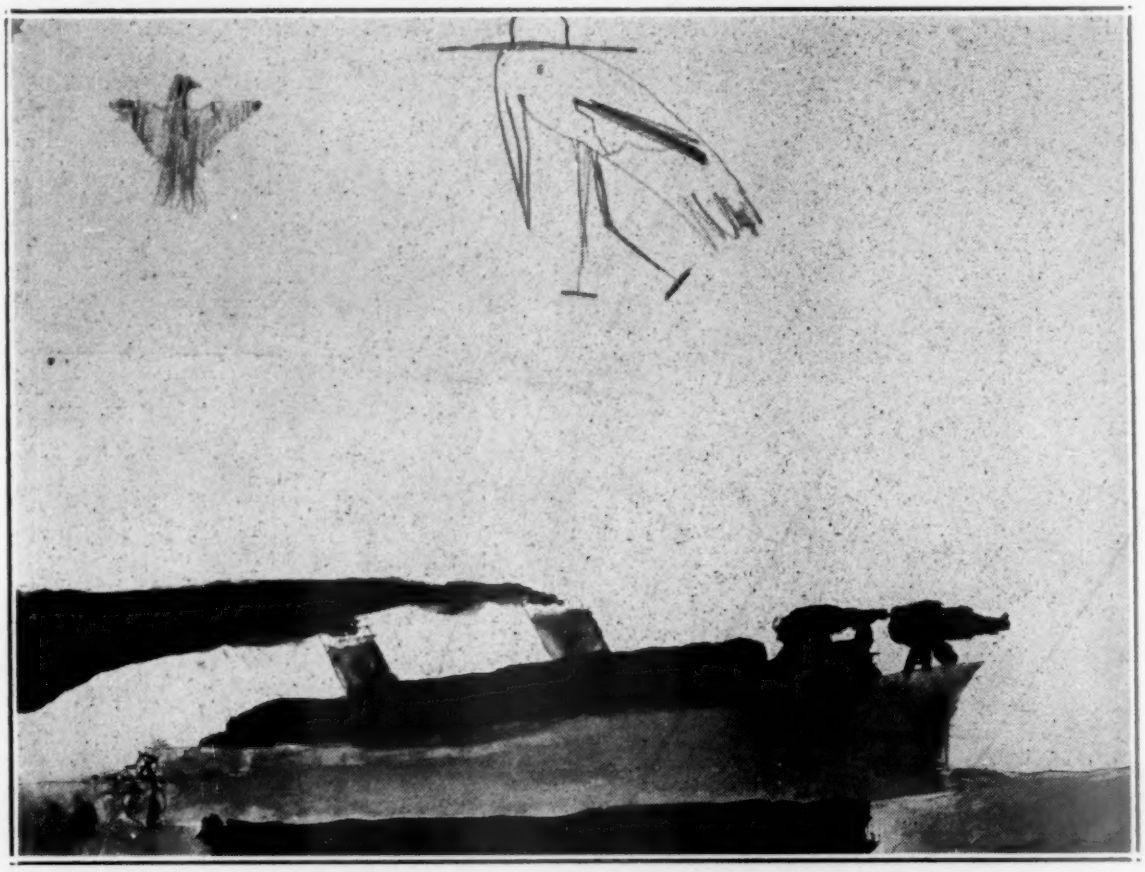


FIG. 2. Ocean liner (26–96)

added and the ground and sky included to complete the composition. Likewise the " Farm Scene " (Fig. 1) is developed from a dominant element, the windmill, also seen in the same journal. The silo, farm animals and other details were added to complete the organization to the satisfaction of the child.

2. *From several images, usually related, an organization of the nature of a composite is developed.* In the more intelligent child art serves the function of aiding in the integration of experience and an organization of the child's world. These children are

possibly more sensitive to their visual world[9] than are average children and as a consequence have more images called up in any given situation. This type of child is not content to depict a simple object based upon a single image or a simple unitary experience. He will select for his drawing or painting a dominant form which is adaptable to embody significant details or aspects of other related forms. Another and perhaps more common expression involves the grafting on to a basic object relevant

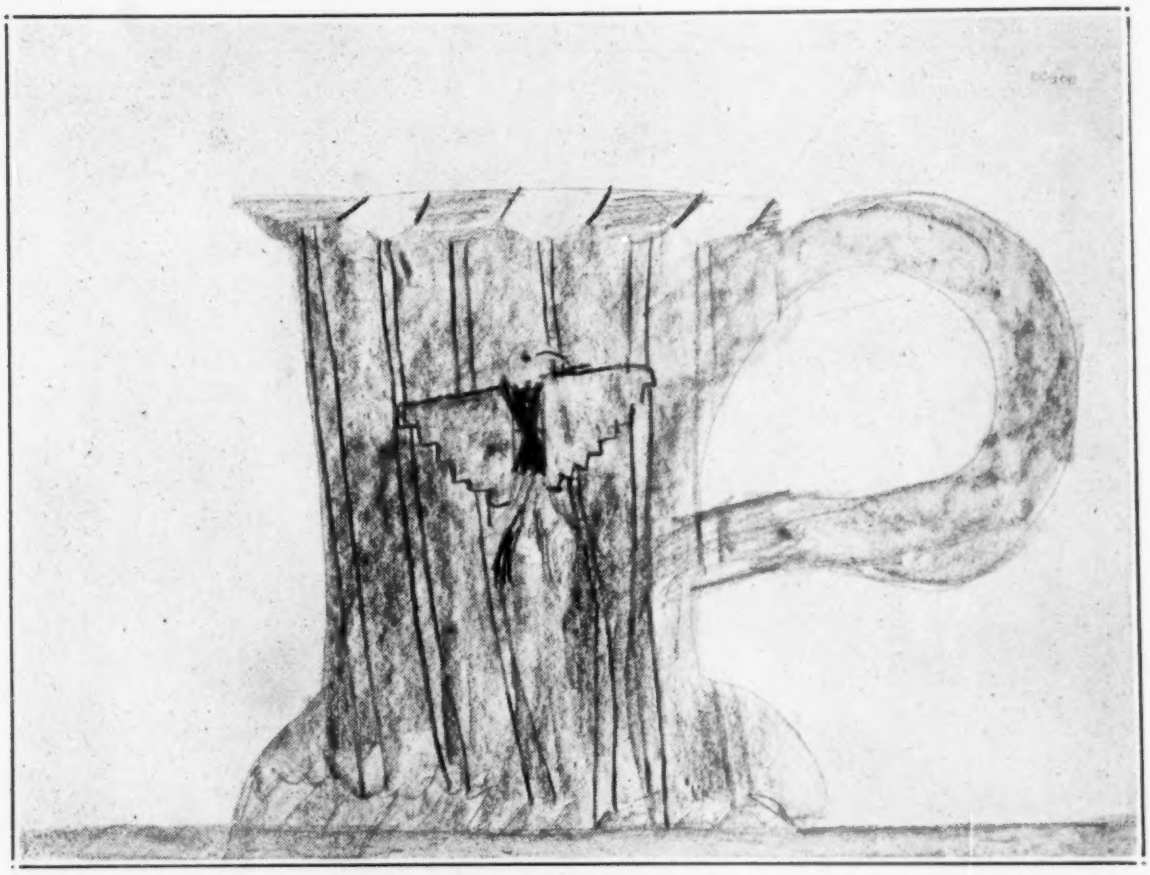


FIG. 3. Indian pitcher (26–100)

and sometimes highly appropriate detail, traceable to related sources, but modified by the child to suit the artistic situation before him. Of the former type of imagination the "Ocean Liner" painting is a good example (Fig. 2). The dominant form in this instance is the ocean liner, traced to a ten-cent book of ships of all times. This form in itself is well-drawn, indicative of the clearness of imagery in the child, yet there is unmistakable evidence that the child also had in mind and incorporated

[9] This was one of the findings in the Tiebout research. Reported in this volume.

in his painting, aspects of the destroyer (mounted guns in the fore-deck) and the Mississippi paddle-wheel boat (paddle-wheel at rear). It must be considered in passing judgment on the logicality of the last item that the child was pursuing art for his own enjoyment and development and not for an adult jury. Fig. 3, "Indian Pitcher," represents a form not traceable to any particular pitcher but probably one developed from a composite image (the child had had opportunity to see Indian pottery). The design on the side is the child's interpretation of the Indian "Thunderbird" design, common in the Southwest and Rocky Mountain region. The vertical stripes and the border decoration are, so far as definitely known, development of the subject, but possibly are adaptations from designs done in school. The color is largely the child's own selection save for the touch of yellow in the "thunderbird" design which was probably remembered.

3. *From several images an improvised theme, resembling the sources more or less, is developed.* This type of performance occurred when the child had difficulty in reviving recent imaginal content but finally exhibited something which in itself was inadequate. On this beginning he improvised until a reasonable or fairly adequate expression answered. Subject XIB in the composition "Wedding of the Rats" began with a drawing of a trunk. This reminded her of her grandmother's trunk in the attic of her home. Then XIB recalled that there had been a rat in their attic at one time. This, with the memory of a picture of a bride in a current magazine led to the final composition.

4. *From a single memorial experience selection is made of various elements of æsthetic interest to the child, to which other elements are added.* The conditions in this situation are essential to the exercise of creative imagination inasmuch as the painting itself exhibits little resemblance to the source excepting in form. New details, new color (or color where none existed in the original), or a complete reorganization of the various elements in the composition have been introduced. This enlarged graphic conception was not arrived at by chance additions or rearrangement: it was apparently developed with due regard for the fitness

and function of each new element and usually resulted in a composition complete in itself. The conception furthermore frequently assumes æsthetic qualities comparable to adult standards of excellence. Plate I(b), "Teeter-totter," represents the development in color and design of an interesting composition from a relatively uninteresting monochromatic book-illustration (Fig. 4) by a 5 yr. old subject (XAJ).[10] The entire work was done by the child alone after she had, in browsing around in the family book-collection, found this illustration and decided of her own volition to paint something like it. The two teepee

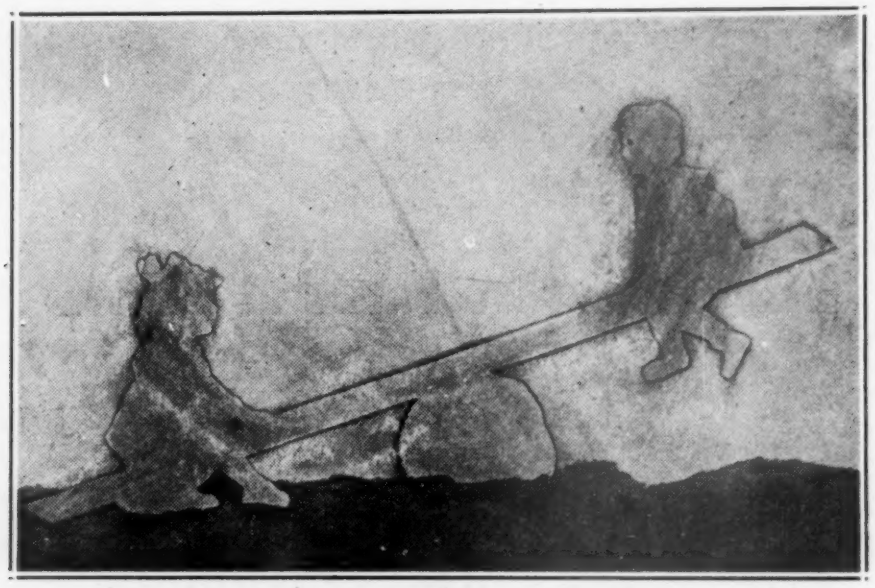
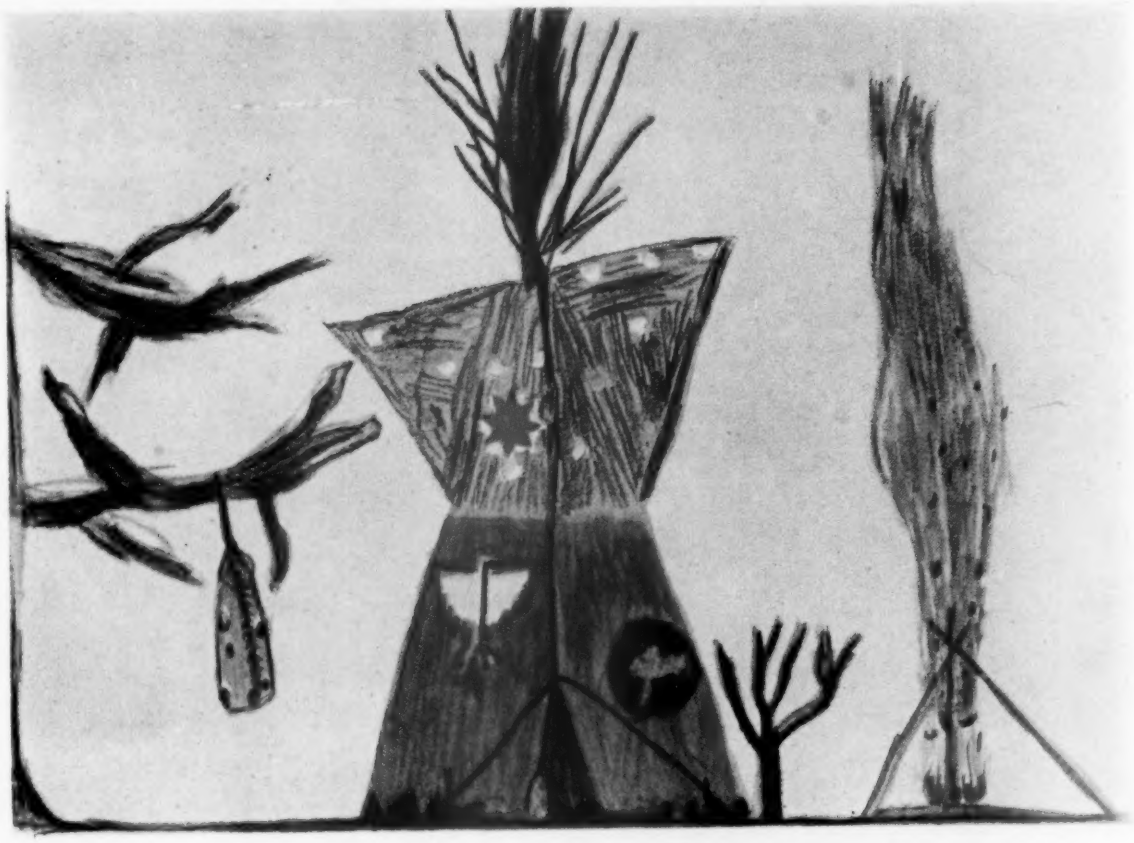


FIG. 4. Source of Teeter Totter painting (20–36—Plate Ib)

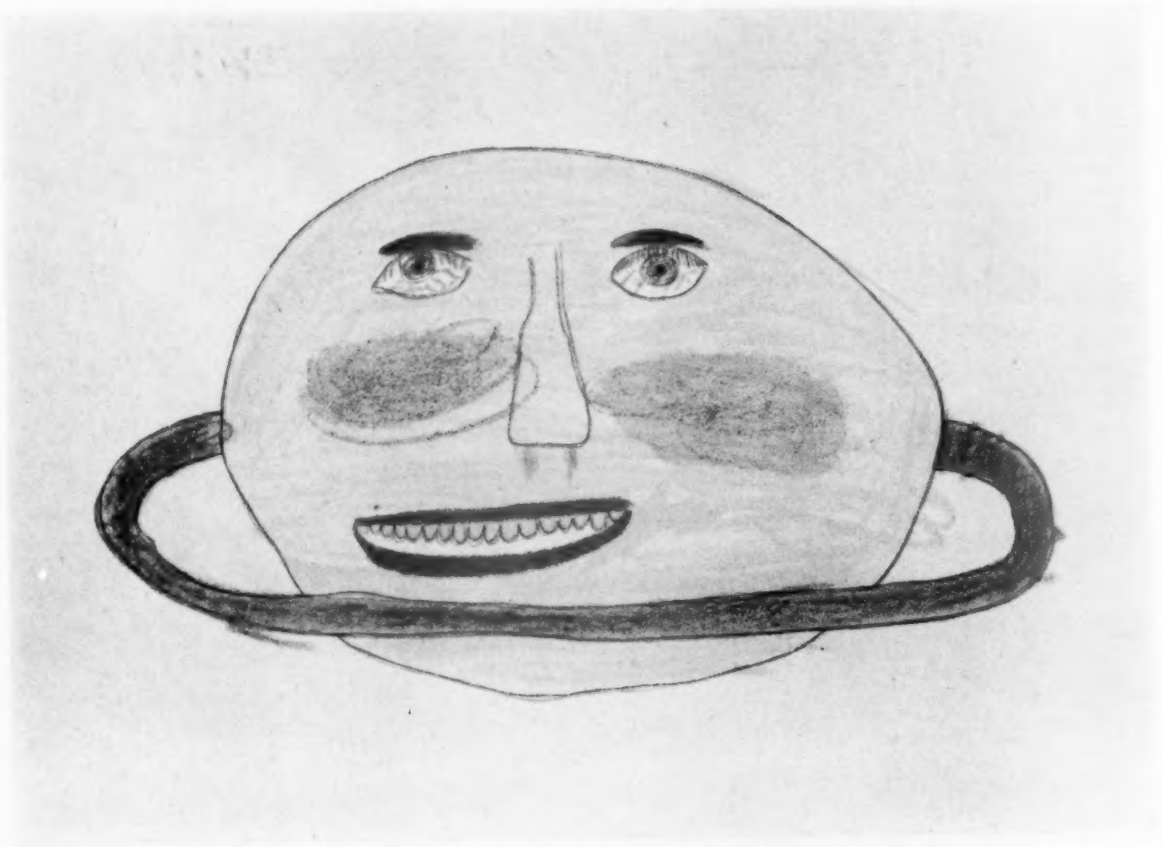
pictures, Plate II(a) and Fig. 5 were painted from the same memory experience, that being an Indian project in grade 2 of the University Elementary School. Fig. 5 represents the "interpretation" of a girl (XIB). The figure with drawn bow is taken from an illustration in a child's paper bound book. The papoose was added, likewise the tree, from a source not discovered. Plate II(a) represents the "interpretation" of a boy (XAM) who saw the teepee at assembly, added the camp-fire and the oak tree with the papoose. The base of the camp-fire was possibly suggested by a detail of the assembly exhibit but the fire and smoke is the child's own construction, antecedents of

[10] From Beecher and Faxon, Practical Methods, Aids, and Devices for Teachers. Dansville, N. Y., F. A. Owen.

PLATE II



[a] Teepee



[b] World With a Cold

which were not discoverable. The papoose is possibly based upon a memorial image from some book-illustration.

5. *From a single memorial experience touching upon some emotional experience, a compositional expression appears as a reaction to both.* Plate II(b), "The World with a Cold," by subject XAM, was traced to a cartoon by Carey Orr in the *Chicago Tribune,* seen some time prior to the date drawn, and to a scolding given the child that morning by the child's parents for

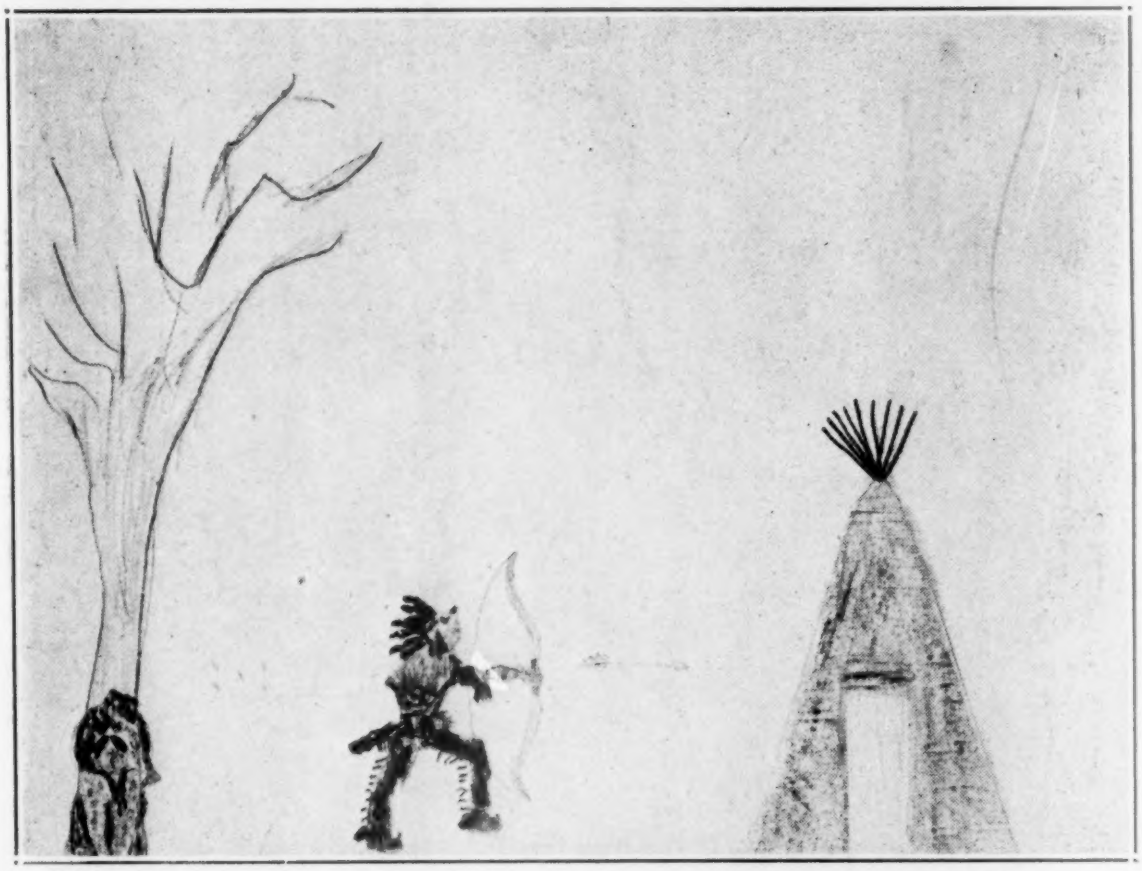


FIG. 5. Indian exhibit (5–12). Source same as Plate IIa.

not taking care of his cold. The drawing was made about two hours later when the scolding was still in his mind. Hence the world with a cold. The cartoon showed the world as a head with a handkerchief, which the child omitted but introduced a ring, remembered from pictures of the planets. In Fig. 6 by ZEW the occasion was the appearance into his home one evening of a bat which flew about the 'paller' for some time, greatly frightening the child. This represents the depiction of a subject who has not shown much interest in drawing except of a certain type of episodal depiction.

6. *From a single vivid aspect of a larger experience residing in the child as a memorial experience (with intellectual and emotional concomitants) an effective expression, often simple in character through avoidance of detail, appears in appropriate compositional setting.* The picture "Lake Okoboji" (Plate III[a]), was painted about six months after the subject, a 6 yr. old girl, had witnessed the scene interpreted. This view of the dock at Arnold's Park, Lake Okoboji, in the judgment of visitors

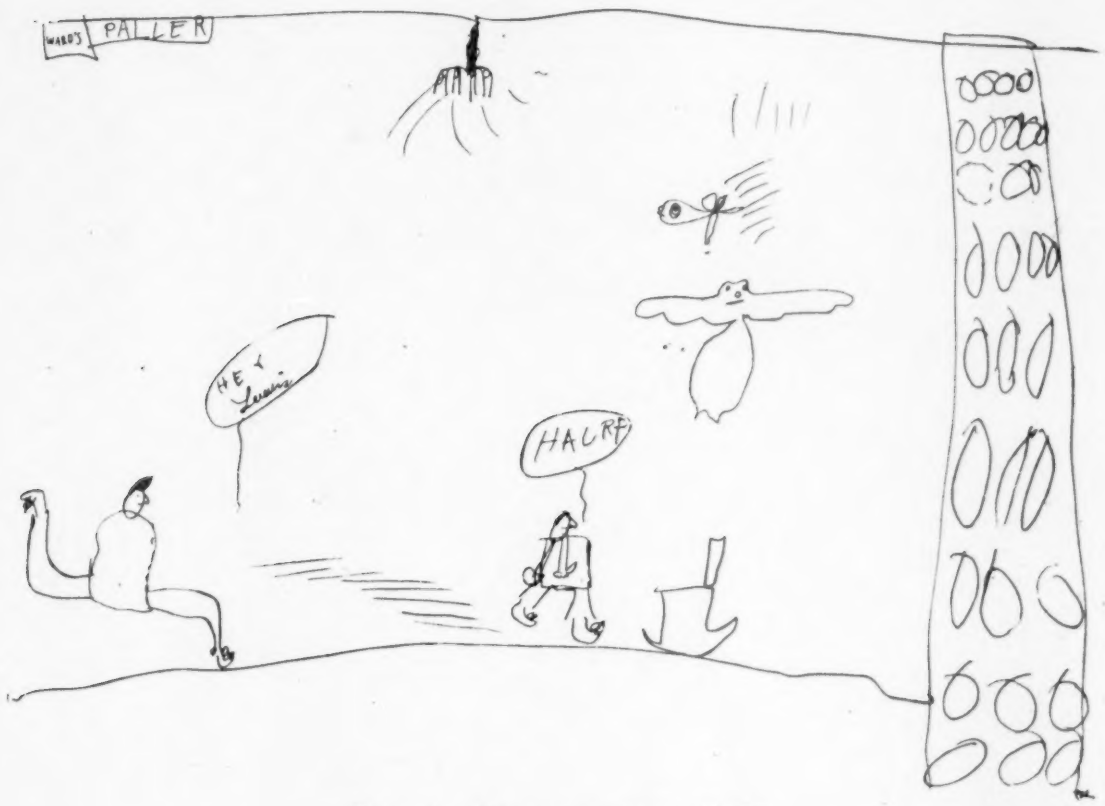
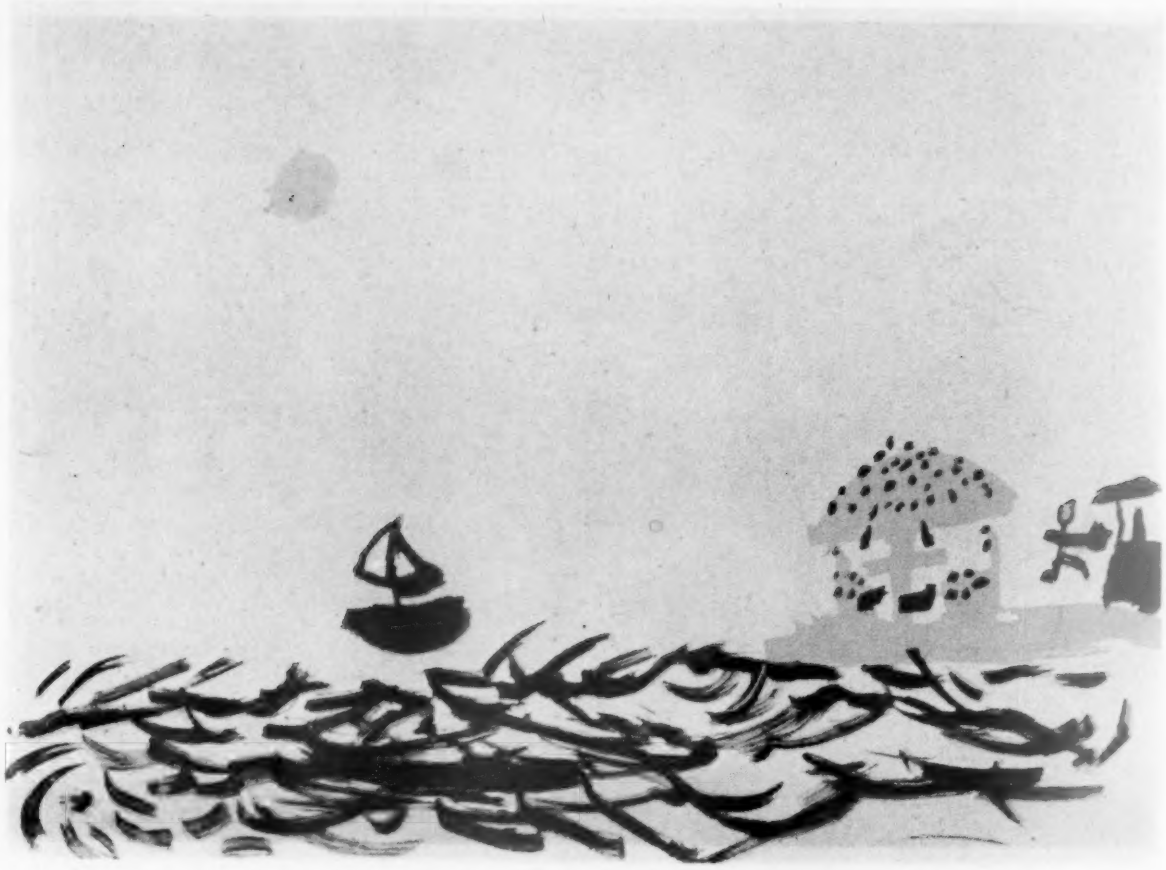


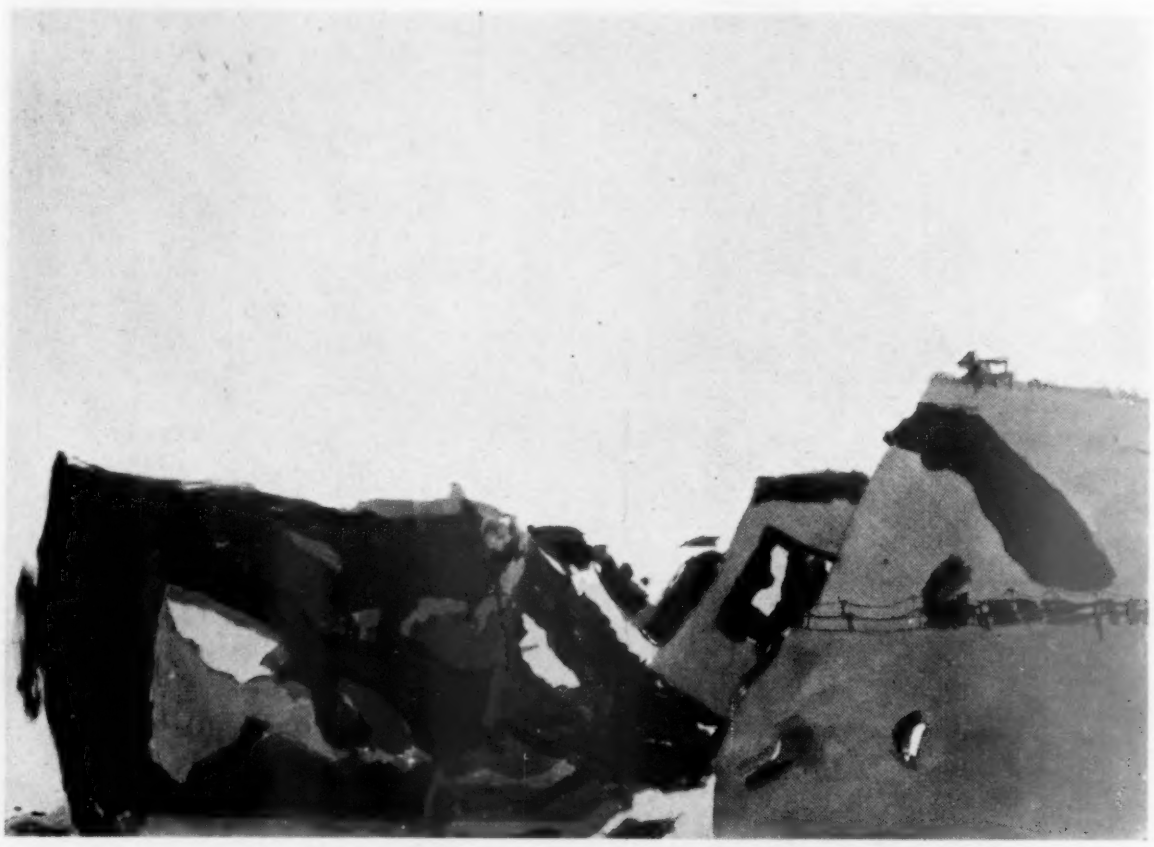
FIG. 6. Drawing No. 45–50

to whom it has been shown is strikingly realistic, the child having very successfully caught the dancing waves, tiny rocking sailboat, and the dock. This seems all the more remarkable when it is known that the child's sole contact with the scene depicted was *limited to a single visit,* lasting about two hours, the imaginal basis for this painting being a six months' old, more or less fleeting, visual image experience while engaged in play with a number of other children. Plate III(b) is a painting made by another 6 yr, old child based solely upon a *single travel experience.* The child saw the Rio Grande Canyon while passing through in an automobile sedan en route from Taos to Santa Fé, New

PLATE III



[a] Arnold's Park, Lake Okoboji



[b] Rio Grande Canyon

Mexico. The entire trip lasted only a few hours and was made about seven months previous to the painting, which was done in the child's home, entirely as a free volition on the part of the child. Aside from the elementary character of the technique this picture suggests with surprising fidelity, the general appearance, coloring and character of the canyon as seen at the north end (the first part entered, 15 mi. south of Taos). As an interesting commentary of this subject's method of consolidating his experiences and imagery it will be observed that a railway and train appear on the right canyon side. This is the narrow gauge railway that appears about 20 mi. farther down the canyon, but is placed in the picture because the child wanted to have the complete experience depicted. This picture demonstrates the astonishing fidelity of imagery in a talented child at the age of 6 yrs.

7. *From a continuing experience over a limited time interval significant elements or aspects are fused into a composition of high character in which form and color are handled in an effective manner.* This type of imagination normally is found in the child of above average intelligence who by circumstances of environment or by temperamental inclination lives considerably to himself. In these moments or longer periods the child is receptive to sensory impressions of an intense character which are retained in much of their original state for considerable periods of time. Plate IV(a), "Summer Shower," by subject XAJ, a 5 yr. old girl, was painted approximately 24 hrs. after she had witnessed the shower from the front vestibule of her home which is situated on a bluff affording a view of the Iowa River valley. In this composition may be observed turbulent rain clouds, such as accompany brief summer showers, the bluff on the left, and a tree which appears to have been made in lighter value just as one would appear as seen in the rain. Since this picture was constructed not with the scene before the child, but after a lapse of 24 hrs., and considering the fact that the composition is not photographically realistic (as would be the case if dependence were placed upon true memorial images), the example is one of creative imagination of an unusually high order. Plate IV(b) represents an example of a composition constructed from a gen-

eral setting often admired by the subject but this particular organization was "inspired" by a particularly vivid impression of short duration. This painting illustrates the general view minus the atmospheric effects developed by the child. The scene is a view from the steps at the front entrance of her home overlooking the Iowa River and the woods in the City Park on the other side. The row of objects in the foreground is a row of telephone poles with their cross-pieces, the highway below being not visible. It should be observed that the child had but two brushes, one 3/8 in. and one 5/8 in., hence the apparent enlarged size of the telephone cross-pieces. The unusual feature of this painting is obviously the gradation of thin clouds toward the west with the maximum light at the horizon.

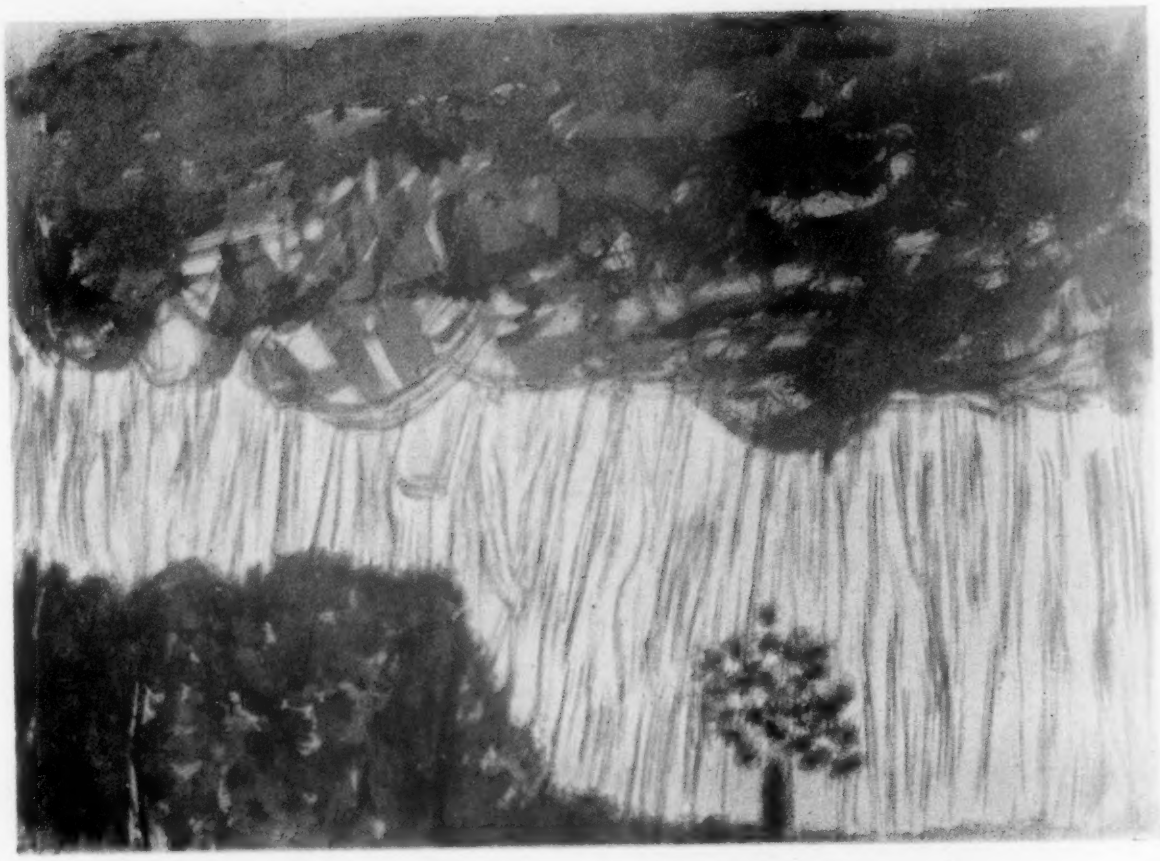
Variation in imaginative conceptions of talented and non-gifted children. Assuming the point of view that in the works of practically all great artists one or more æsthetic qualities or principles may be found, the 146 paintings made in the above series by subjects in both groups were studied for the presence or absence of compositional elements. Table II presents the results:

TABLE II.

Talented Group	Total No. Drawings	No. exhibiting compositional elements
XIB	17	16
XAM	19	18
XAJ	15	12
XAP	16	14
Total	67	60
Non-talented Group		
ZAS	16	1
ZAV	16	0
ZIW	16	1
ZAG	15	1
ZEW	16	1
Total	79	4

It will be observed that 89 per cent of the paintings of the talented group reached the compositional level while only 5 per cent of the non-gifted were of this character. Most of the work of the latter group were generalized depictions of simple objects or stereotyped forms, while the talented tended to create a composition from even elementary and simple beginnings.

PLATE IV



[a] Summer Shower

[b] Twilight

A second characteristic separating the two groups was in the degree of critical attitude displayed. The talented child was seldom satisfied with the first appearance of any phase of his work and usually expressed his critical evaluation of each stage, often in specific terms. In producing the 67 paintings of the talented group of four subjects there are in the stenographic records 77 instances of verbal criticisms of a definite character. In the 79 productions by the disinterested group of five subjects, only four instances appear. Since the capacity to sense slight deviations and variations in æsthetic quality (æsthetic judgment) is regarded as a crucial trait in the adult artist contributing toward his success, the foregoing facts would indicate that the trait exists at the child level. This view is in accord with the findings of Meier,[11] *Bergeman-Könitzer* (3), *Neuhaus* (24), *Hirsh* (10) and others.

As a further check on the verbalizations accompanying the graphic statement of the imaginative organization, the amount of speech and the time consumed by each subject was computed from the stenographic transcriptions and the time as recorded by the investigator. Table III shows for each subject in the two groups the number of paintings; number of lines (range, average, and total); the number of lines of relevant speech (range, average,

TABLE III.

Subject	No. of Paintings	Total Lines			Relevant Lines			Total Time		
		Range	Ave.	Total Lines	Range	Ave.	Relevant Lines	Range	Ave.	Total Time In Min.
Artistically Gifted Subjects										
XIB	17	27–136	54	919	22–129	51.5	876	5– –40	16.6	282
XAM	17	38–448	143	2724	33–260	135.2	2569	9–130	36.0	702
XAP	16	10–53	30.9	495	10–61	30.8	494	6–30	11	178
XAJ	15	13–85	41.7	626	13–77	39.6	594	2.5–15	8.2	123
Artistically Disinterested Subjects										
ZAS	16	8–21	12.3	196	1–7	3	48	3– –12	4.4	70
ZAV	16	8–21	14	225	1–4	2.5	40.5	1.5–4	2.7	45.5
ZIW	16	15–55	32	514	3–24	10.6	170	1.5–16	6.6	105.5
ZAG	15	7–24	14.8	222	7–23	13.6	202	1– –7	3.1	47
ZEW	16	9–52	10.7	268	3–17	6.3	101	1– –7	3.5	53

[11] In discussions with 31 artists at Toronto, Taos, Santa Fé, New York, Laguna Beach and Carmel-Monterey, Dr. Meier found that æsthetic sensitivity was placed in a position of first importance by nearly all of them.

and total); and the time in minutes (range, average, and total). The number of standard lines on a standard 8½ in. x 11 in. typed sheet was made the basis of measurement. These data show enormous variations in the speech activities of the two groups and individual differences as great as 64 times, in the amount of relevant speech. In terms of the amount of time this difference becomes 16 times greater in favor of the talented child. Naturally great differences would be expected yet the fact should not be overlooked that this difference represents a difference in *unstimulated* interest to a very considerable extent.

The average time of the drawing period for the talented group was four and one-half times that of the non-talented. The average number of lines for the talented group was 67.4 and, with deductions for irrelevancy, 64.3. For the non-gifted this was 16.7 and, with irrelevant items deducted, only 7.2. These figures suggest a much higher attentive capacity for artistic activity on the part of the talented subjects.

Certain qualitative differences marked the products of the two groups. Although all subjects had a choice of four water colors or seven colors in crayon, few of the untalented made use of them. Of the 67 products of the X group only three are monochromatic, whereas of 69 products by the Z group only five are in more than one color, two being in four colors, and one in five.

Principles of art and æsthetic qualities appeared in a considerable proportion of the talented subjects' work. This was previously observed at Merrill-Palmer school by *Cockrell* (4) in her study of children's paintings. In the talented subjects there was a definite attempt to produce an organization satisfying to the subjects' own ideas. In the responses to the interrogations of the investigator regarding sources the X subject could usually identify the source, yet the child's compositions were rarely like the source. There were, furthermore, frequent examples of a careful proportioning of the objects to fit space limitations and a harmonizing of one element with another. Composition was seldom attained by the Z group.

The sources of the graphic concepts of the subjects were varied with the greater number coming from books, magazines and pic-

tures. Table IV presents the sources for 137 paintings by the 9 subjects whose work was studied most intensively. A significant aspect of these data is that, while the two groups have traveled about the same, practically no travel experience provided themes for paintings on the part of Z subjects, whereas travel provided about 15 themes for the X group.

TABLE IV. *Sources of graphic ideas of children* *

	XIB	XAM	XAP	XAJ	ZAS	ZAV	ZIW	ZAG	ZEW
Books, pictures, magazines	5	10	3	2	0	1	0	0	4
Movies	0	0	2	0	0	0	0	0	0
Local environment, physical	3	0	3	7	2	5	4	2	2
Immediate environment (events preceding)	6	4	5	3	2	1	3	4	2
Stereotyped objects, forms	0	0	0	1	7	1	4	2	1
Travel									
recent	1	1	4	4	0	0	0	1	0
6 mo.–1 yr.	1	3	0	0	0	0	0	1	0
1 to 2 yr.	1	1	1	0	0	0	0	0	0
Unknown or not easily identifiable, composite	1	1	0	0	1	6	2	2	4
Misc. assembly of source material	1	1	0	1	0	0	0	0	0
Purely imaginative constructions	2	1	1	1	0	0	0	0	0

* Average of four judges.

Summary and conclusions. Forty-eight children between the ages of three and seven years, nine months were studied by the constant contact procedure for creative artistic imagination over periods of from 3 to 18 months. In the later stage attention was concentrated upon four talented subjects and five non-talented or artistically disinterested subjects in order to discover by contrast the variations between the two types. The procedure provided two parallel records for more intensive study, a graphic statement of the child's imaginative organizations (the painting), and a running account of his mental content while painting (a verbatim stenographic record of all that both subject and investigator said during period).

The preliminary work disclosed that except in rare instances creative imagination does not function in children below the age of five, but that some children at the age of five exhibit a degree of it comparable to children seven years old.

Seven categories of imaginative functioning were recognized

in the 146 paintings and drawings produced under semi-experimental conditions. These represent all the various ways in which artistic conceptions of normal children come into being, though half of the subjects selected for intensive study in the later stage of the investigation were distinctly superior children in art. The categories follow:

1. Revision of a single memory image.
2. Organization on the nature of a composite from several images, usually related.
3. Improvisation of a theme, resembling the source or sources, from a number of images.
4. Selection of various elements of æsthetic interest, to which other elements may be added, all based upon a single memorial or sensory experience.
5. Compositional expressions arising as a reaction from a single memory touching upon some more or less strong emotional experience.
6. Effective expressions appearing in appropriate compositional setting from a single vivid aspect of a larger experience residing in the child as a memorial experience.
7. Fusion of compositional elements or aspects into a composition of high character, from a continuing experience over a limited time interval.

Analysis of the main body of 146 drawings and paintings made by the two groups, the X (talented) and Z (artistically disinterested) disclosed extreme differences in both quality and character. Those of the X-group included a high proportion, 89 per cent, that reached the compositional level, whereas only 5 per cent of the Z-group attained that state of development. In many of the paintings of the X-group there appeared also principles of art and an occasional attainment of æesthetic quality comparable to adult standards.

The X-subjects exhibited a marked tendency to criticize their own work which frequently took on a specific and definite character, indicating that these children had in an elementary way some degree of the æsthetic judgment of the professional artist.

The sources of the child's imaginative conceptions were found to be principally (a) incidents in the local and immediate environment, (b) physical aspects of the local environment, (c) books, magazines and pictures, and (d) travel. The source material of the X-group exhibited a fecundity of ideas and careful development of them not only in the choice of colors, but in attention to detail.

Analysis of data, collected on length of time at work and amount and degree of relevancy of mental activity while painting, indicated that differences as great as sixty times existed in the extremes of the two groups in mental activity while painting when relevant content only was considered and as measured by standard typed lines. The lowest amount by any X-subject was more than twice that of the highest Z-subject. This implies a vastly higher attention and perseverative capacity for the artistically talented child.

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PLAYGROUND BEHAVIOR DIFFERENTIATING ARTISTIC FROM NON-ARTISTIC CHILDREN

by

MILDRED DOW

Introduction. The question as to whether differences in personality distinguish individuals of one profession from those of another has received considerable attention in both popular and psychological thought. A long standing popular belief in such a difference is expressed by the term "artistic personality," but only recently has this belief been subjected to experimental attack. *Carroll* (2) found that scores of university students on art tests and on temperament or personality tests correlated to a negligible degree. He concluded that his data did not support the current idea that talent in art tended to be associated with personality disorders. This study approached the problem of the "artistic personality" from a different angle. It disregarded the question of maladjustment, did not deal with the behavior of the adult who has been subjected to the influence of the professional group, but aimed rather to find if differences appeared in the *total pattern of habitual behavior* of the artistic *child* as compared with the total pattern of behavior of the child who was less talented artistically. The free play period on the school-ground seemed to be a situation which would allow these differences, if they existed, to be observed clearly. Here the child is relatively free from any control and may choose according to his own inclinations any activity from a wide range. Here fundamental differences in personality organization might reveal themselves before the influence of later training and group attitudes were effective.

Statement of the problem. In the present study the following questions were considered: (1) is there a difference in the

reaction patterns[1] of an artistically superior group of children as compared to an artistically inferior group of children; (2) is there a difference in the amount of progressive activity[2] of this artistically superior group as compared to the amount of progressive activity of this artistically inferior group?

Subjects. The subjects used for this comparison were children selected from the Preschool of the Iowa Child Welfare Research Station and the Iowa University Elementary School.

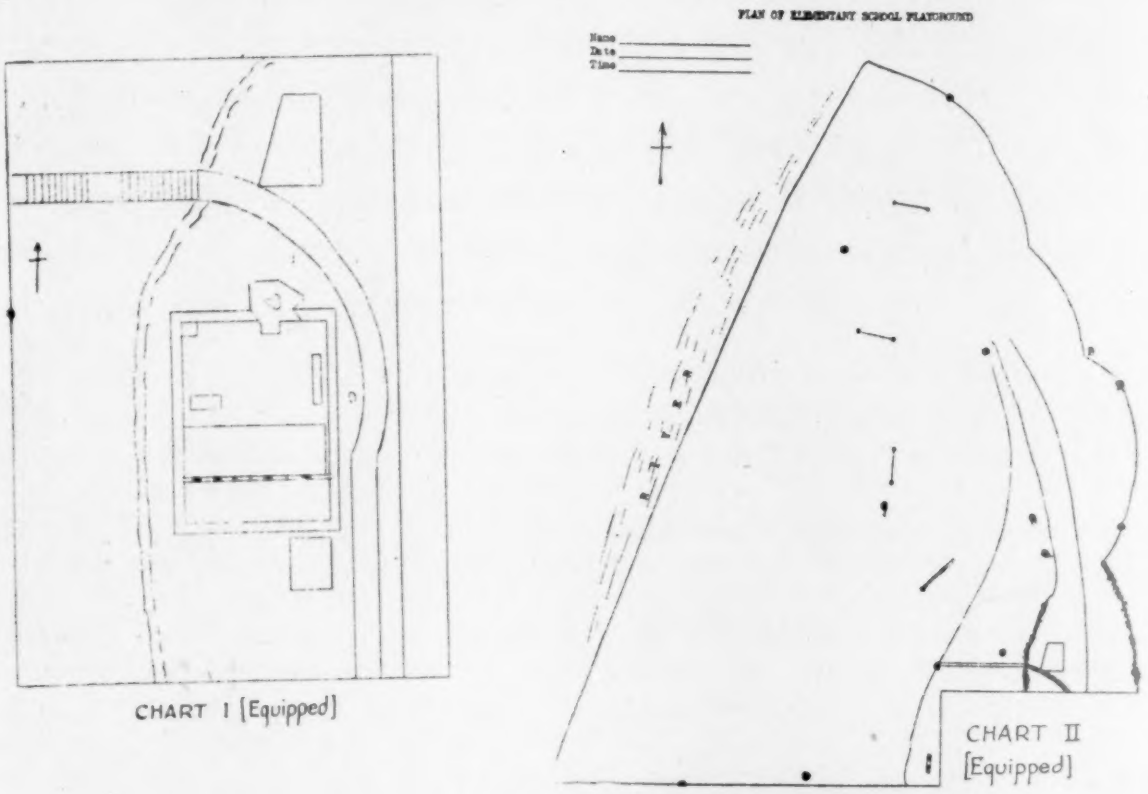

FIG. 1. Layouts of equipped playground

These children were also used in the studies of *Grippen* (7), *Tiebout* (9), and *Rodgers* (8). The procedure of selection is described more fully by *Rodgers.* In brief, the selection was made on the basis of (1) ratings of children by teachers, observers, and others, (2) scores made on the Kline-Carey Scale, Part I, (3) evaluation of eighteen exercises in art in Junior Primary, Grades I and II, and (4) evaluation of drawing and painting products. Eleven children were thus selected, repre-

[1] A reaction pattern is defined as a typical adjustment of the individual to his environment based upon native constitution and systems of habit.

[2] By progressive activity is meant movement which covers territory, goes from place to place.

senting the six most artistically talented (X subjects), and the five least artistically talented (Z subjects) out of approximately 100 children. In the Junior Primary, there were two boys (XAR, ZAV) and one girl (XAJ); in the first grade, three boys (XAM, ZAG, ZEW) and one girl (XAP); in the second grade, three girls (ZAS, XAB, XEB) and one boy (ZEW).

Procedure and technique. Four scaled plans of the school playground (Fig. 1) were prepared by a surveyor, one for each of

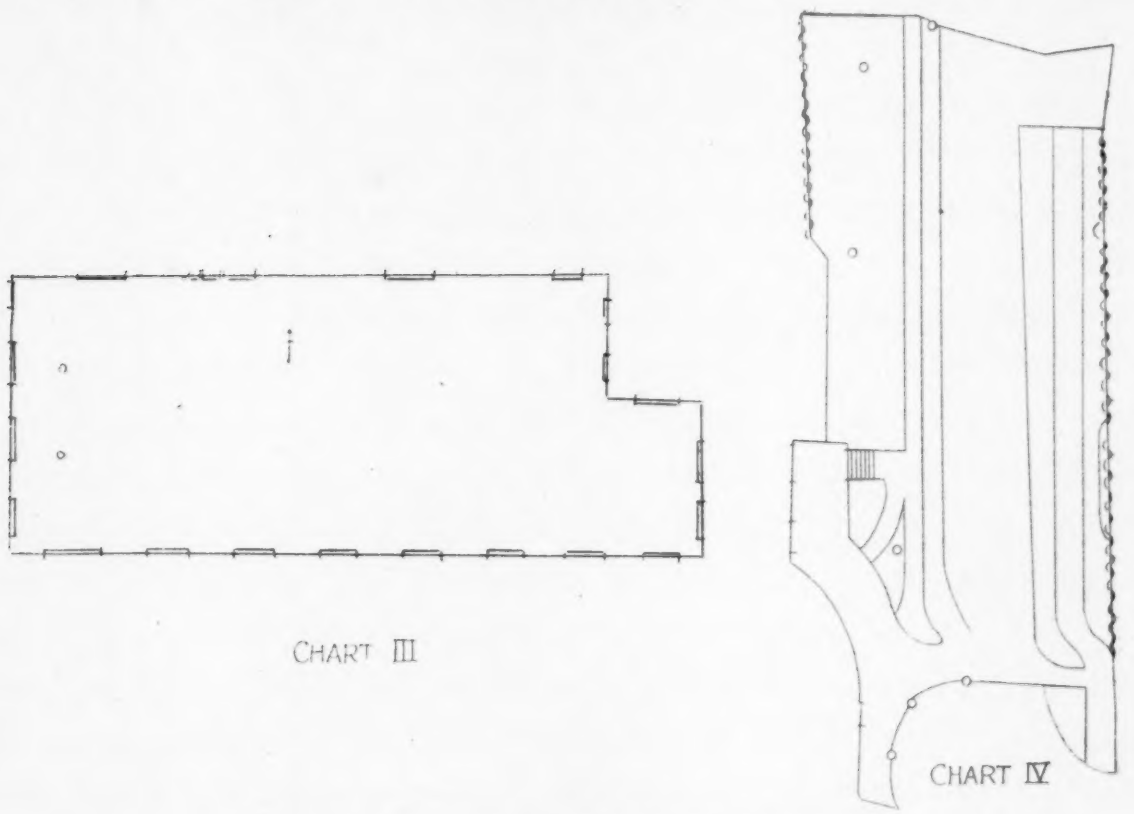

FIG. 2. Layouts of unequipped playground

the playgrounds on which the children played. Chart I represented a small playground and its surroundings to the northeast of the University Elementary School, containing two sandboxes, swings, trapeze, two ladders, a bench, a work table, boxes, a small raised platform built around a tree stump, a cement walk, and steps. Chart II represented a very large playground north of the University Elementary School, both on the level and with a hillside, equipped with sand box, walk and steps, a slide, four swings, a swinging bar, a stationary bar, and goal posts. Chart III represented a roof playground on the first floor of the school. It was perfectly bare save for a box or two, and ventilators. Chart IV represented the entrance walk, the upper terrace, road,

and another terrace to the east of the school grounds. It had no equipment save a wall and walks.

The observer stood at a point from which the entire playground was in view and traced by means of a line drawn on the appropriate chart, a particular child's movement from point to point on the playground. One child was observed for one minute. In this same period a diary record (6) of all the activities in which the child engaged within that moment was made on the same chart. Then a second child was observed for a moment, *etc.* After a preliminary trial of the method, the actual series of observations, several taken each day and repeated many days, extended from December, 1931, to the last day of May, 1932. To treat the observational records, the following classificatory scheme was evolved. It defines and delimits each of the more important types of behavior found in these records.

THE SYSTEM OF CATEGORIES FOR THE ANALYSIS OF DIARY RECORDS

Directions. The same category may be checked only once during the minute interval. At least one item in each of the two divisions, *reactions to equipment* and *reactions to persons,* should be checked. If there is no apparent reaction to equipment, the category, *non-material,* is checked. If there is no apparent reaction to persons, the category, *non-participation,* is checked. Within the two main divisions where items are mutually exclusive, the definitions will so designate. To score, the sum of the checks for each category is divided by the number of minutes. This reduces the scores for observational series of varying length to a comparable basis—the percentage of total time spent in a given activity.

A. Reaction of the child to objects. The child's attention is directed toward the use of equipment.

Non-material. The child is not engaged with equipment but his reactions are primarily directed toward other persons. Examples: The child chases another. Watching other children.

Material. The child exploits the intrinsic possibilities of the object with no other apparent purpose. This excludes the use of objects as tools or aids in the activity. In swinging, for example, the child utilizes the pleasure-giving possibilities of the swing without any form of production nor make-believe activity. Examples: Climbing a ladder. Bouncing cap off of head. Going to material.

Observational. The child looks at, watches objects without otherwise reacting toward them. This excludes watching persons, which is classified under *Onlooker.* Example: Looking at a motor boat.

Constructive. The child uses material as a tool with which to construct something. The use of material as aids to dramatic play is excluded. Any sand-activity is arbitrarily considered to fall in this category unless a group is involved in dramatic play with only a minor use of sand, such as "playing family." Examples: Digging sand. Writing with a stone on a wall.

B. *Reaction of the child to his own body—purely physical activity.* The child's own body is the object of the activity. He exercises his own physical being with no other apparent end in view save that of muscular reactions for their own sake. This eliminates the use of any sort of equipment.

Non-active. The child sits or stands without physical activity. Example: Standing on a box by the ladder.

Non-progressive physical. This includes activity in which territory is not covered in a progressive or forward manner. The child does not leave a certain spot. Example: Jumping up and down.

Progressive-physical. The child moves in a forward progressive manner. Example: Running for the sake of running.

C. *Reaction of the child to persons.*

Non-participation. The child plays alone, or near another person without regard to him. However, his attention must be engaged by something other than people, for this is classified under *Onlooker* activity. Example: Working alone although other children are all about him.

Onlooker-behavior. The child watches others without joining in their play. Example: Watching. Activity directed towards better watching.

Attempt to participate. The child attempts to join the group, or to cause others to participate in group activity with him. Attention seeking or attempting to show off is also considered here. Examples: Provokes others to chase him. Joins the group. "Look, Miss ...."

Individual unco-operative activity. The child refuses to join group activity, leaves group activity, or interferes with another child or the group. This type of behavior is characterized by an unfriendly attitude and assumes that the child acts as an individual not with a gang. Examples: Knocks boy over. Draws away from group. Tells on child.

Gang-activity. This includes a loosely organized group in which a number of children band together so as to disturb another child or group. Example: In a group with B and J, coming to jump on C.

Unorganized grouping. The child is among other children, but the activities are not directed toward a common end as in a game or a project. It is rather that the individual seems to be characterized by the attitude of wanting to be with other people and get a response from them. Examples: Takes hold of J's hand. Standing, talking to child.

Individual co-operation. The child plays with other children in a functional way or plays with the same material, suggestions from the other child affecting his activity. They are working together towards a common end. Example: Helping the child to lift a box.

Game. A pattern of activity in which one child is necessary to the activity of the other. Example: Playing "follow the leader".

Dramatic. The child projects himself into a situation foreign to that present at the time. He is pretending, participating in make-believe. Examples: Playing rabbit, family.

Project. Involving constructive work towards an end and involving division of the group into leader and followers. Example: Helping put ladder up.

Results. Comparison of scores by means of graphs indicated that time of day exerted no effect but that there were appreciable differences accompanying the presence or absence of play materials on the playground. Scores were accordingly computed for each child on Playgrounds I and II (equipped—E) for all periods of the day, and for Playgrounds III and IV (unequipped—U) for all periods. From these scores the mean value for each of the four groups—artistic boys (XM), non-artistic boys (ZM), artistic girls (XF), and non-artistic girl (ZF)—was obtained for each of the various reaction patterns. To ascertain if the differences between the means were real differences, *Fisher's* formula (4, p. 108), previously interpreted by *Tiebout* (9) for determining the means of small samples, was applied. The mean scores and the significances of the differences of these means are presented in Table I.

There were scores for only one non-artistic girl, hence statistical treatment of the significance of the difference of the mean scores for the two playgrounds could not be determined for this group, but for all other groups, statistically significant differences appear favoring equipped playgrounds for constructive (groups XM, ZM, XF), observational (ZM), and project (XF) activity, while on unequipped playgrounds significant differences favor non-material (XM, ZM, ZF) and progressive physical (XM, ZM) activity. Since the subjects were so few, a P. from .05 to .3 is considered to be indicative of more positive results if a larger group of children could have been used. The differences thus approach significance for the following categories: equipped playgrounds favor non-progressive physical (XM), observational (XF), material (XF), non-participative (XM), individual unco-operative (ZM), individual co-operative (ZM); unequipped playgrounds favored non-active (XM), progressive physical (XF), attempt to participate (XM, ZM), onlooker (XF), gang (ZM, XF), game (XM, XF). The apparent conclusion to be drawn from a study of the type of activity involved in these categories is that the presence or absence of play materials has caused a true difference in the type of reaction displayed, in that there is more material and non-social play on equipped play-

TABLE I. *Comparative percentages of occurrence of reaction patterns of artistic and non-artistic children*

Reaction Pattern	Play-ground	AM				P[3]			
		XM	ZM	XF	ZF	XM–ZM	XF–ZF	XM–XF	ZM–ZF
Non-mat'l	E	5.0	13.2	10.9	5.0	.6–.5	.4–.3	.3–.2	.4–.3
	U	41.4	54.0	48.6	57.1	.5–.4	.9–.8	.8–.7	.9
	P EU	.02–.01	.05–.02	.05–.02					
Non-active	E	3.1	3.6	2.7	15.0	.9–.8	.2–.1	.9	.1–.05
	U	5.7	9.4	7.7	35.7	.9–.8	.05	.9–.8	.6–.5
	P EU	.3–.2	.6–.5	.4–.3					
Non-progressive physical	E	4.5	.7	1.4	.0	.05–.02	.1–.05	.1–.5	.7–.6
	U	1.0	0.4	13.7	7.1	.6–.5	.8–.7	.1–.05	.02–.01
	P EU	.2–.1	.6–.5	.3–.2					
Progressive physical	E	12.6	5.2	8.8	.0	.1–.05	.2–.1	.4–.3	.3–.2
	U	50.2	20.4	29.1	7.1	.01	.6–.5	.9	.2–.1
	P EU	.02–.01	.01	.3–.2					
Observation	E	4.0	1.0	6.0	15.2	.1.05	.2–.1	.8–.7	.01
	U	5.2	0.0	0.0	0.0	.2–.1	1.0	.2–.1	1.0
	P EU	.9–.8	.01	.3–.2					
Material	E	38.6	23.6	33.9	35.0	.6–.5	.9	.8–.7	.7–.6
	U	24.4	12.0	5.9	0.0	.5–.4	.7–.6	.2–.1	.6–.5
	P EU	.6–.5	.5–.4	.2–.1					
Constructive	E	43.5	28.5	40.7	5.0	.4–.3	.2–.1	.9–.8	.3–.2
	U	1.3	2.0	0.0	0.0	.9–.8	1.0	.2–.1	.7–.6
	P EU	.05–.02	.02–.01	.01					
Dramatic	E	15.1	32.4	10.2	45.0	.6–.5	.2–.1	.8–.7	.5–.4
	U	15.4	17.2	3.8	0.0	.9–.8	.7–.6	.2–.1	.3–.2
	P EU	.9	.4–.3	.5–.4					

[3] *Fisher* (**4**, p. 108).

Reaction Pattern	Play-ground	AM XM	AM ZM	AM XF	AM ZF	P³ XM–ZM	P³ XF–ZF	P³ XM–XF	P³ ZM–ZF
Non-participative	E	22.0	10.0	25.6	25.0	.1–.05	.9	.7–.6	.2–.1
	U	13.1	6.6	5.0	7.1	.6–.5	.9	.1–.05	.9
	P EU	.2–.1	.7–.6	.7–.6					
Attempt to participate	E	14.1	14.9	19.4	20.0	.9	.7–.6	.5–.4	.8–.7
	U	45.0	26.0	13.9	7.1	.2–.1	.7–.6	.1–.05	.1–.05
	P EU	.3–.2	.1–.05	.5–.4					
Onlooker	E	36.6	29.6	33.9	25.0	.6–.5	.7–.6	.9–.8	.8–.7
	U	46.1	29.4	57.7	78.5	.4–.3	.5–.4	.6–.5	.1–.05
	P EU	.7–.6	.9	.2–.1					
Unorganized group	E	39.8	20.8	28.6	40.0	.3–.2	.6–.5	.5–.4	.5–.4
	U	33.8	24.2	26.1	14.2	.5–.4	.8–.7	.8–.7	.6–.5
	P EU	.8–.7	.9–.8	.9–.8					
Individual unco-operative	E	4.5	32.1	11.4	5.0	.5–.4	.7–.6	.6–.5	.7–.6
	U	7.3	17.0	10.2	0.0	.2–.1	6–.5	.8–.7	.3–.2
	P EU	.5–.4	.1–.05	.9					
Gang	E	2.6	.3	0.0	.0	.3–.2	.1–.0	.2–.1	.9–.8
	U	1.0	6.6	4.4	0.0	.5–.4	.6–.5	.5–.4	.6–.5
	P EU	.7–.6	.2–.1	.2–.1					
Individual co-operative	E	2.6	5.5	9.0	0.0	.2–.1	.4–.3	.3–.2	.01
	U	3.4	3.0	4.9	0.0	.9	.2–.1	.7–.6	.6–.5
	P EU	.9–.8	.3–.2	.4–.3					
Game	E	9.1	27.0	11.4	10.0	.4–.3	.9–.8	.7–.6	.6–.5
	U	27.8	38.7	40.7	21.4	.4–.3	.7–.6	.7–.6	.2–.1
	P EU	.3–.2	.4–.3	.2–.1					
Project	E	8.4	7.8	4.8	0.0	.9	.05–.02	.1–.05	.4–.3
	U	2.1	5.7	0.0	0.0	.7–.6	1.0	.2–.1	.7–.6
	P EU	.6–.5	.8–.7	.05					

grounds and more non-material and social play on unequipped playgrounds.

Comparing the artistic and non-artistic groups on equipped playgrounds, we find a statistically significant difference between the X and Z boys in favor of the former in non-progressive activity and differences approaching significance in progressive physical, observational, non-participative, unorganized group, and gang activity. Non-artistic boys excel in individual co-operative behavior. It has been explained previously that wherever non-progressive physical, progressive physical, or observational patterns are checked the activity did not accompany a form of group play as game, dramatic, *etc.* Hence these results, with the greater amount of non-participative and unorganized group and gang activity, would indicate that the primary difference between these two groups lies in the lesser sociability of the artistic boys in this situation. Artistic girls have a statistically significant lead in project activity and leads approaching significance in non-progressive physical, progressive physical, and constructive activity. The non-artistic girl was almost significantly more engrossed in non-activity, observational, and dramatic patterns. The primary difference between the girls seems to be that of work with materials.

On unequipped playgrounds the X boys lead significantly in progressive-physical activity and scores approach significance in observational and " attempt to participate " behavior. The non-artistic boys engage in more individual unco-operative activity. Between the girls there is a statistically significant difference in favor of the non-artistic girl in non-active behavior. The artistic girls engaged to an almost significant degree in more individual co-operative activity. In general differences still appear, but the two groups tend to become more similar in reaction pattern on the unequipped playgrounds, the artistic boys becoming more sociable in comparison to the non-artistic boys than was the case on the equipped playgrounds while the pattern of activity of the two groups of girls is very similar.

Comparison of sexes within each artistic group discloses that on equipped playgrounds there are differences approaching sig-

nificance in the following patterns: non-material (XF), individual co-operative (XF), non-active (ZF), observational (ZF), non-participative (ZF); in favor of the boys, non-progressive physical (XM), gang (XM), project XM), progressive physical (ZM), constructive (ZM), and individual co-operative (ZM). On unequipped playgrounds differences favor the girls in non-progressive physical (XF, ZF), and onlooker (ZF) behavior. They favor the boys in observational (XM), material (XM), constructive (XM), dramatic (XM, ZM), non-participative (XM), attempt to participate (XM, ZM), project (XM), progressive physical (ZM), individual unco-operative (ZM), and game (ZM) activity. It seems that while lack of play materials makes the activities of artistic and non-artistic groups more similar it decreases appreciably the similarity of activities of boys and girls within the same group, and that on both playgrounds the boys appear to engage in the more active behavior.

The records of progressive activity were measured chartometrically, converted into feet traversed per minute, and the mean value of the scores for each of the four groups and the significance of the differences between these means determined as before. The results are presented in Table II.

TABLE II. *Amount of progressive activity of artistic and non-artistic children on equipped and non-equipped playgrounds in terms of distance traversed in feet*

	XF	ZF	P XF–ZF	XM	ZM	P XM–ZM
Equipped	30.85	55.9	.1 – .05	35.4	81.57	.01 – .00
Unequipped	85.8	24.6	.3 – .2	97.6	135.65	.5 – .4
P E–U	.7 – .6			.1 – .05	.01 – .00	

We find that the Z group, both boys and girl, excel the X group in progressive activity on equipped playgrounds. The boys of the Z group are considerably more active than the girl, but the Z girl is considerably more active than the X boys. Boys and girls of the X group are approximately equal in amount of activity. On unequipped playgrounds the Z boys still excel, but the X boys are next in order and the difference between the two scores is no longer significant. The girls reverse positions, the X girls becoming considerably more active than the Z girl and this difference approaches significance. There are significant

gains in activity from equipped playground to unequipped in the case of the boys and we find that the X boys have gained more in activity than any of the other groups. The conclusion would follow that on equipped playgrounds the X group is less active than the Z group, but that on playgrounds without equipment the amount of progressive activity becomes more comparable, and that this difference of reaction, at least in case of the boys, is a true difference. On the other hand, the amount of activity becomes more differentiated between the sexes within a group. Hence we find this portion of the study corroborates that of the previous section.

Reliability. Reliability of observation, computed by the Pearson Product Moment formula, from scores of records simultaneously secured by another observer and the investigator was .95±.00. Scores of odd minute records were likewise correlated with scores on even minute records to determine reliability of sampling. For equipped playgrounds, r was .82, with a reliability of .90 for the entire series of observations by Spearman's prophecy formula; for unequipped playgrounds, r was .78, a reliability for the whole of .87. Measurements of a randomly chosen set of records (zero records omitted) by two observers yielded a correlation by the Pearson formula of .99±.001. To determine reliability of classification, two observers independently classified activities recorded in sixty diary records. A correspondence of 80 per cent was obtained by the percentage of agreement method. It is very probable that a greater amount of preliminary training of the second observer would have considerably increased this figure.

Summary and conclusions. Six artistically superior and five artistically inferior children were compared as to differences in reaction patterns and differences in progressive activity in a playground situation. A series of one minute observations were made of individual children over a period of several months in which the movement of the child was charted on a map scaled for this purpose and a diary record taken of all the activities of the child. The records were combined into two groups, one group representing two playgrounds on which there was much play equip-

ment, the other including the records for two playgrounds on which there was practically no equipment. Diary records were classified according to a system of categories and the percentage of occurrence of each activity in the total play time of the child was secured. Progressive activity was measured chartometrically and converted into feet. Comparison of the means of four groups, artistic boys, artistic girls, non-artistic boys, and non-artistic girl indicate the following conclusions:

1. There are differences in types of reaction exhibited in free play on a playground containing much play equipment and those exhibited in free play on a playground containing little play equipment which are statistically significant.

2. These differences are primarily dependent upon the presence or absence of equipment.

3. There are differences in the types of reaction exhibited upon an equipped playground by artistic and non-artistic children. Artistic children engage less in physically active and social play and more in play involving equipment than do non-artistic children. On a playground possessing no equipment these differences tend to disappear.

4. Differences in types of reaction and amount of activity between boys and girls within an artistic or non-artistic group increases when the children are playing on an unequipped play ground over those exhibited on an equipped playground.

In general we conclude that probably the primary difference between artistic and inartistic groups is revealed in the greater interest of the artistic group and the correspondingly greater response to play materials. The child therefore plays less with other children and is less physically active in his play. It is interesting to note that while artistic groups become more similar on unequipped playgrounds, boys and girls within a group become more differentiated in behavior. The predominant change appears to be the greater increase of the artistic boy in sociability and activity. This suggests interesting sidelights on the question as to why girls of this age are in general rated more artistic than boys, and the question of supposed femininity of artistic boys. According to the above results because of their

greater inactivity, girls may devote more time to play with materials of which art materials are a part. Because artistic boys, when materials are present, prefer to play with them to the exclusion of social and active behavior, they seem less masculine in behavior than their more physically active companions. These statements go beyond results established by this study but perhaps they form new interpretations of interest for further experimentation.[4]

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[4] This study is being followed by one on the interests of artistic and non-artistic children, a report of which will appear at a subsequent date.

VARIATION IN THE ÆSTHETIC ENVIRONMENT OF ARTISTIC AND NON-ARTISTIC CHILDREN

by

FRANCES RODGERS

Introduction. It is now believed that general intelligence is constant within certain limits, but the range of these limits is by no means agreed upon. The studies of the Iowa Child Welfare Research Station group have demonstrated that the environment has material effect in the raising or maintenance of the IQ (32). There is reason to believe that a special form of intelligence which has been given the designation æsthetic intelligence (25) possibly is subject to similar conditioning.

The object of this study was to ascertain if high artistic intelligence was directly related to highly æsthetic environment and low artistic intelligence to æsthetically poor environment. This involved (a) the identification and segregation for purposes of study of a number of artistically superior children and a like number of artistically inferior children and (b) the devising of a technique for quantifying the probable æsthetic stimulus afforded by the environment in the case of each child.

Discussions of the interrelations of heredity and environment such as those by *Baldwin* (2), *Bernard* (4), *Carmichael* (7) and others treat the whole general problem and throw little light upon this specific aspect. This study limited itself to the fact of existing relationship, regarding the present environment as of chief importance but securing as much as possible of the recent past environment, which in the subjects studied, covered not more than four or five years. The investigation was further limited to the physical environment, regarding the social as being too complex and elusive to bring under any measure of control.

For the purposes of the study *environment* was interpreted as

inclusive of anything having æsthetic import that was present or that had been present to stimulate the child, or that might reasonably have been assumed to have affected his perceptual consciousness. *Environment,* hence, was taken to embrace not only the constant physical surroundings (house, trees, flowers, neighborhood vistas); interiors (furniture, wall decorations, pictures, *etc.*), movable objects (books, toys and other playthings, paints, crayons, *etc.*), but transient environment as well (that experienced in travel and visits such as cities, ferry-boats, seaside objects, *etc.*). Objects of repeated contact (home, father's office or farm, *etc.*) were given especial study.

The investigation was regarded as a test of one phase of the genetic theory of talent outlined by Meier,[1] abstracts of which follow:

> "Individuals come into the world with neural equipment and sense organs of different degrees of development and acuity. . . . . The possession of superior developmental equipment is a precondition which prepares the stage for the evolvement of 'natural artistic capacity.' . . . . . "
>
> "Indications point strongly to the elements in the environment to which the child becomes effectively and affectively sensitive. Such an individual in whom the experiences had been numerous, frequent and emotionally significant would probably have a high degree of æsthetic insight, assuming that he was similarly responsive to other qualities. . . . . "
>
> "The individuals who have lesser degrees of it would be those (a) who did not have the initial advantage of an early maturing, efficient neural equipment and sense-organs—having had the experience in some frequency but with an inadequate impression not productive of permanent effect, or those (b) who have good neural equipment but interests which direct their activities toward other, æsthetically non-significant objects. This different environment may consist either of different social—adult associates not interested in things artistic—or a different physical world, having a preponderance of objects not primarily of any significance æsthetically."

It was assumed that extreme variation in artistic capacity might be explained either by extreme variation in environment or extreme variation in psychophysical equipment. This study attempts to test the former assumption.

Procedure: Two instruments, one of analysis, the other of a rating character, were needed to survey and to quantify the æsthetic stimulus in the environment of each subject.

A. The first of these, the *Environmental Analysis* form, cover-

[1] Meier-Seashore, Manual for the Meier-Seashore Art Judgment Test, Appendix A.

ing eight pages, was designed to enable the investigator to secure a large amount of raw data in a detailed and logical manner, as preliminary to comprehensive study later. Much of this data was substantiated or authenticated by interview with parents, research assistants and others to check upon minor changes of recent origin, particularly portions which were secured from official records of the Iowa Child Welfare Research Station.[2] Pages one to three inclusive cover data relating to parents, travels, physical and mental development of subject, outdoor and indoor play facilities, five play materials most frequently used, use of time, five favorite books, general æsthetic character of illustrations and child's pictures, personality of child, *etc.* Pages four to middle of page eight are devoted to an "Inventory of Gross Physical Surroundings," covering physiographic classification of area, flora, fauna (*e.g.*, such as is, or has been, available to the child, as zoölogical gardens, domestic animals, pets, circus visits, museums, *etc.*), cultural area, the homes visited each year; detailed analytical descriptions of house in which subject lives (*e.g.*, type or style of architecture[3] with art principles involved, plot arrangement, façade, plan arrangement, *etc.*). Interior study involved among other details, type of wall trimming, floors and floor covering, drapes and curtains, wall hangings, furniture, *etc.* The lower half of page eight covered travel and other experiences having æsthetic significance.

Preliminary use of the *Environmental Analysis* form disclosed the fact that the *æsthetic character* of the objects familiar to the subject was of major importance rather than mere inventory. Relations of objects to one another and to setting, moreover, were of as much significance as the individual character of each. These observations led to the construction of the second form.

B. The "Qualitative Index of the Relative Æsthetic Opportunity in the Environment" (referred to hereafter as *Qualitative Index*), was accordingly produced, including a device for securing an æsthetic value rating on each of 122 items, these being

[2] Acknowledgment is made for the co-operation and frequent aid rendered by staff members of the Station.

[3] The investigator was aided by an architect, Mr. J. Bradley Rust, in the development of this phase of the study.

those judged to be of primary æsthetic significance. Included were aspects of the interior of the home, the exterior, neighborhood vistas, representative books, home library and transient environment.

Scoring. Each of the enumerated items was rated on a scale ranging from −10 to +10. Zero to +10 represented degrees of positive æsthetic quality, +10 being regarded as the hypothetical maximum realizable in the situation judged. Zero to −10 was representative of scores of an unæsthetic character, −10 being the hypothetical maximum. A +5 rating would therefore indicate an item of average æsthetic value. Judgments were formed on the basis of the following principles: proportion, emphasis, sequence, rhythm, alternation, radiation, stability, balance, color-harmony and textural harmony. Two more items had reference to the general relation of parts to the setting, harmony and fitness, and provision was made for a general summation of all related items in each unit. Definitions and interpretations of principles followed were as given in the *Whitford Terminology Report* (33). This basis for estimates and ratings was followed not only by the investigator but also by each of the judges who made independent ratings for purposes of establishing reliability.

It was of course not necessary nor feasible to make 854 judgments for each environment, for the reason that every home did not have every one of the items and some principles did not apply to specific items.

Subjects. A. Detroit group. Several years prior to this study a collection of the drawings and paintings of children at Merrill-Palmer School in Detroit was made (12). These were shipped to Iowa City and an analysis was made of 1,550 of them for the æsthetic qualities contained in these. This study was made by competent research assistants who were trained in art with considerable work also in psychology, and furthermore had made scores in the 98th or 99th percentiles of two art judgment tests. On the basis of this study names of those children who made consistently good paintings were secured.

With this list as a nucleus, children in the Merrill-Palmer were placed under observation, further study was made of their recent

art products and finally a ranking of 32 children, secured from members of the Merrill-Palmer staff most closely in touch with the children, was made. The placements were dictated by three considerations: (a) the child's interest in art activities, (b) time expended in art work, and (c) a comprehensive study of the completed art products of the child. Results of these independently made rankings showed little or no disagreement at the extremes but variations in the middle range. Since more could be learned by a study of the contrasted extremes it was decided to take as subjects the seven highest and seven lowest, the former being referred to hereafter as the X group, the latter as the Z group.

B. Iowa City group. The University of Iowa has in its pre-school laboratories and Elementary School a co-ordinated system wherein the same child may enter at the age of two years and progress through the entire system. This situation provides opportunity for a follow-up of subjects for experimental purposes and genetic study and was used in this investigation. Subjects who had been under observation for several years were now given ratings by the pre-school teachers, research assistants, and the art teachers (on those in the Junior Primary and above). These ratings were based on the following considerations: (a) the child's interest in art activities, (b) time expended in art activity through his own initiative, and (c) an estimate of the completed art products. Ratings were made in the fall semester of 1930 and again in the spring of 1931. A third rating was made toward the end of the year. Subjects were selected for the two groups (X and Z) finally on the bases of (a) consistency of appearance of names, (b) weight given to competence of judges in their opportunity of observation and æsthetic judgment, and (c) availability of the child as a subject (attitude of parents, attitude of child).

All subjects below the age of five were eliminated because of (a) disagreement among raters, (b) failure to find adequate differentiation between products of subjects, (c) insufficient opportunity of raters to know subjects well, and (d) generally inferior art products.

Two further checks were employed: scores made on the *Kline-*

Carey Drawing Scale[4] and reference to an evaluation of drawing products of most of the subjects under consideration made by three members of the art education staff.[5]

The subjects thus selected, 13 artistically superior and 12 artistically disinterested, represented two widely contrasted environments, one urban, one a small mid-west community (15,000–20,000 population). Sex, chronological age, IQ, and occupation of parent follow:

Detroit subjects

Subj.	Sex	Birthdate*	IQ	Occupation of parent
XAL	F	2/20/1922	127	Orthodontist
XAS	M	12/29/1922	116	Mechanical engineer
XAW	F	7/28/1924	151	Dentist
XAG	F	12/30/1925	142	Physician
XIW	F	4/26/1923	130	Aeronautical engineer
XEW	F	10/ 6/1924	128	Aeronautical engineer
XEB	F	2/ 6/1925	127	Airforce
ZAM	F	3/12/1924	130	Dentist
ZAT	M	4/ 3/1925	Ave.	Lawyer
ZAR	M	6/14/1925	100	Instructor
ZAO	F	2/20/1924	110	Builder
ZOW	F	1/25/1923	Sup.	Physician
ZAW	M	8/14/1921	105	Wholesale cigar employee
ZUW	M	1/25/1923	Sup.	Physician

* Study began about Sept. 15, 1931.
X—Superior subjects
Z—Inferior subjects

Iowa City subjects

Subj.	Sex	Birthdate*	IQ	Occupation of parent
XAB	F	7/19/1924	139	Surgeon
XIB	F	9/29/1924	94	Lawyer
XAP	F	4/ 1/1925	120	Professor
XAM	M	12/19/1925	166	Professor
XAJ	F	9/ 2/1926	131	Dentist
XAR	M	11/26/1926	142	Professor
ZAS	F	3/ 7/1925	113	Electrical engineer
ZIW	M	4/21/1925	103	Farmer
ZEW	M	7/20/1925	114	Professor
ZAG	M	12/14/1925	109	Roentgenologist
ZAV	M	9/25/1926	124	Professor

* Study began about Jan., 1931.
X—Superior subjects
Z—Inferior subjects

[4] See Grippen, V., this number.

[5] Moeller, E. A comparative study of the development of graphic and plastic art ability in young children through two different methods of art instruction. M.A. thesis, Univ. of Ia., 1931.

Procedure: Both groups were studied in much the same way except that the Detroit subjects were all covered in an intensive three weeks' survey and the Iowa City group over a period of more than a year. The data were collected from two sources. (1) *From records.* In Detroit the Merrill-Palmer School records were available in their entirety, including in addition to the general comprehensive record of each child case studies made by Merrill-Palmer students, reports made by staff members, observational data and test records. (2) *Field study.* The home of every subject was visited at least twice; many of them five or six times. Entree was forthcoming through previous contacts by the school and in Iowa City groups by supplying the subjects with easels and painting materials. This was true also of most of the Detroit subjects; in all instances a completely co-operative attitude was found. Usually it was arranged for another investigator to accompany the writer so that mental notes could be made on the ground without taxing either one's limit. Diplomacy and tact were utilized in avoiding commitments on the true nature of the visits (which were ostensibly for the purpose of examining subjects' playthings, books, *etc.,* to see if these entered into his drawing subject-matter).

Reliability. Two homes, one of an inferior and one of a superior subject were selected at random, and re-rated after an interval of four months. This showed indication of good reliability and it was planned to check this further by having three competent judges check three representative environments independently. To reduce somewhat the possibility of familiarity of any judge a photographic technique was introduced, utilizing a Model D Leica camera as the most mechanically perfect instrument for the purpose. Approximately 25 pictures were made of each environment, covering nearly every aspect of the home both within and without. Prints of these were mounted on gray cardboard and ranked by five judges.

Results: [6]

Ratings of exteriors—averages

Item	X-subjects		Z-subjects	
	Detroit	Iowa City	Detroit	Iowa City
Home—general	7.86	6.83	6.30	5.40
Architecture	7.71	6.17	5.43	5.80
Placement	8.14	8.00	5.00	6.60
Trees	8.14	7.00	4.84	5.60
Shrubbery	8.30	7.50	4.14	5.60
Neighborhood	8.57	7.17	5.00	5.80
Adjacent homes				
Right	8.44	7.75	6.30	5.40
Left	8.18	8.00	5.55	5.25
Across	8.18	6.50	4.20	4.50
Ave.	8.17	7.22	5.20	5.55

Ratings of interiors—averages

Item	X-subjects		Z-subjects	
	Detroit	Iowa City	Detroit	Iowa City
Stairway	7.33	7.00	4.71	5.67
Entrance	8.18	7.78	6.43	6.34
Living Room	7.54	7.15	6.20	4.76
Dining Room	7.41	7.26	6.36	4.58
Solarium	8.93	8.90	8.20	
Play Room	8.02	6.90	6.18	4.62
Ave.	7.53	7.50	5.94	4.10

Ratings on reading material

Item	X-subjects		Z-subjects	
	Detroit	Iowa City	Detroit	Iowa City
Format	8.83	8.37	6.58	7.40
Illustrations	9.17	8.67	6.52	6.80
Library	9.15	7.83	6.43	4.80
Interest	9.43	9.33	6.40	5.40
Ave.	9.15	8.55	6.48	6.10

Travel—estimated mileage covered

Item	X-subjects		Z-subjects	
	Detroit	Iowa City	Detroit	Iowa City
Range	400–4,400	870–15,640	400–5,600	1000–13,230
Average	2,414	7,288	2,671	7,030

Reliability. In the Detroit ratings, made over a period of three weeks, each home was given two ratings made at intervals

[6] Detailed results are on file in the University of Iowa Library

of about ten days. Seven months later the Qualitative Index for two homes was re-rated from memory with the following result:

	Perfect agreement	Within 1 point
XAL	.83	1.00
ZAW	.73	1.00

In the Iowa City group three homes were given three ratings made independently by three competent judges, utilizing the Qualitative Index in the manner followed by the writer. Results are presented in Table I.

TABLE I. *Reliability*

Subj.	Judges	Agreement	1 point	2 points	3 points
XAJ	R–W	.31	.84	1.00	
	R–G	.65	1.00		
	R–M	.62	1.00		
	W–G	.22	.89	1.00	
	W–M	.31	.85	1.00	
	G–M	.65	1.00		
ZIW	R–W	.64	1.00		
	R–G	.64	.97		1.00
	R–M	.50	.92	.97	1.00
	W–G	.44	.97		1.00
	W–M	.28	.89	.94	1.00
	G–M	.39	.94	.97	1.00
XAP	R–W	.17	.79	1.00	
	R–G	.69	1.00		
	R–M	.43	.86	1.00	
	W–G	.23	.85	1.00	
	W–M	.11	.46	1.00	
	G–M	.34	.86	1.00	

In order to check the general impression afforded by the immediate home environment as a whole, Leica camera studies were made which included interior views of those parts of the house frequented most by the child, exteriors, neighborhood vistas and any special features. The number of individual pictures (1 in. x 1½ in.) approximated 25 per home. By aid of a panorama device it was possible to secure an almost complete panorama from the spot most frequented by the child and by means of the range finder and a photometer type of exposure-meter, it was practicable to get perfect interior views even in poorly lighted interiors. The prints were uniformly of needle-

sharp definition. All the prints of a given home were mounted on a single gray cardboard 8½ in. x 11 in. in size. These were then submitted to five judges (the former three, one artist, and one architect) who ranked them according to the whole æsthetic effect. These are shown in Table II.

TABLE II. *Ranking of judges*

Subjects' Home	W	J	M	S	G	R	Ave.*
XIB	8	8	8	8	8	8	8.00
XAJ	1	2	2	4	1	1	1.80
XAM	3	3	3	3	3	3	3.00
XAP	2	1	1	1	2	2	1.50
ZAS	5	6	5	5	6	5	5.30
ZAV	4	4	4	2	4	4	3.66
ZEW	6	5	6	6	5	6	5.66
ZIW	7	7	7	7	7	7	7.00

* 1 = superior. 8 = inferior.

Subjects' Home	Ave. of Interior Ratings	Ave. of Exterior Ratings	Composite Ave.*	Rankings: Investigator's Rating	Rankings: Judges
XIB	4.4	3.7	4.1	7	8
XAJ	8.6	8.9	8.8	1	2
XAM	6.6	6.5	6.6	3	3
XAP	7.2	7.2	7.2	2	1
ZAS	5.0	5.7	5.4	5	5
ZAV	4.4	6.6	5.5	4	4
ZEW	3.0	5.4	4.2	6	6
ZIW	—2.5	4.0	.8	8	7

* + 10 to 0 = Superior, — 10 to 0 inferior.

Correlation of judges' rankings with investigator's ratings yielded a value for P of .95. This coefficient translated into an r value (Table XX in *Garrett*) = .95 with P.E. = ±.002.

Summary and conclusions: This study was projected for the purpose of answering the question whether variations in artistic competence could be explained by the æsthetic stimulus afforded by the environment. For practical purposes and reasons the immediate and permanent environment was concentrated upon on the assumption that, whereas the ultimate total environment of any one subject could not be known, a significant segment of each child's environment could be studied with sufficient intensiveness to provide a fairly adequate and trustworthy estimate of the probable character of the æsthetic stimulus surrounding the subject.

By various available and appropriate techniques, data were secured on the exteriors and interiors of the subjects' homes, the immediate neighborhood vistas, the playthings, books, as well as on the transient environment (travels, visits), to which each subject had been exposed. Attention was also given to material of a pictorial character, as the pictures, illustrations of books, content of scrap books and the like. This material was given quantitative and qualitative statement by means of two prepared forms: "Environmental Analysis" and the "Qualitative Index of the Relative Æsthetic Opportunity in the Environment."

Two areas were studied, one urban, Detroit, Michigan, utilizing subjects and resources of the Merrill-Palmer School; the other a small city community, Iowa City, Iowa, in which the co-operation of the staff and resources of the Iowa Child Welfare Research Station were available.

Results show that in general the better permanent environment surrounds the more artistically competent child, but to this general conclusion several conspicuous exceptions exist. Specifically, there is some superiority in the case of exteriors and interiors of homes as in the Detroit results the total average of exteriors was 8.17 for superior subjects and 5.20 for the inferior subjects; in Iowa City 7.22 for the superior subjects as against 5.55 for the inferior subjects. The results of ratings of interiors indicate 7.53 for the superior Detroit subjects and 5.94 for the inferior Detroit subjects; in Iowa City the superior subjects' interiors of homes averaged 7.50, and the interiors of the inferior subjects 4.10.

In regard to the data for books and reading interests the superior subjects again have the advantage as the Detroit superior subjects' score was 9.15 in comparison with the inferior subjects' average of 4.65. Likewise in Iowa City the average of the superior subjects was 8.55 and of the inferior subjects 6.10.

There is less differentiation in the travel results. In Detroit the superior subjects have traveled somewhat less than the inferior subjects as the averages are 2,414 miles for the superior subjects and 2,671 miles for the inferior subjects. In Iowa City, however, the superior subjects again have the higher average with 7,288 miles, and the inferior subjects an average of 7,030.

To the extent that the subjects used are representative of the general child population, the following conclusions are offered:

1. In general, the better environments surround the children selected by various tests as being artistically competent. In a contrasted group of children untalented artistically, as shown by the same procedure, somewhat less æsthetic environments are present.

2. These differences are more pronounced in the children's books and interest expressed or shown in them, and exterior surroundings, and fairly definitely pronounced in the case of interiors.

3. In the case of transient environment, inconsequential differences were found. Travel is practically non-existent as an explanatory factor.

4. It is evident from the above that, inasmuch as children in the artistically inferior class frequently possess books of high grade and have other elements of their immediate environment of a grade equal to, or in some instances superior to, some of the artistically superior children, environment as herein studied is not a vital factor in the explanation of variation in artistic competence of children.

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THE PSYCHOPHYSICAL FUNCTIONS DIFFERENTIATING ARTISTICALLY SUPERIOR FROM ARTISTICALLY INFERIOR CHILDREN

by

CAROLYN TIEBOUT

I. Introduction. Artistic capacity may be interpreted psychologically as a resultant of the early and accelerated development of certain psychophysical functions which analysis indicates to be involved in expression through art media. To determine experimentally those functions in which superior development characterizes artistically superior as opposed to artistically inferior individuals was the problem of this study. In answering this question as to the distinguishing traits of the artist's equipment, the approach was made at the child level, beginning with the earliest age at which artistic capacity could be definitely detected and at which differences in the same are sufficiently marked to make possible the selection of two contrasted groups of artistic and non-artistic for purposes of comparison. By the use of the two highly selected groups it was planned to throw into relief the characteristics of the artistically superior child and at the same time to avoid confusion in the findings which would in all probability result from the inclusion of the undifferentiated middle range of artistic ability. The small number of subjects also made practicable the canvassing of a wide range of possible differentiating traits which was desirable in view of the exploratory nature of the study.

Similar studies of the psychophysical traits correlated with success in art have been made with older subjects by *Manuel* (26) and more recently by *Dreps* (4). On the basis of scores made by 19 talented subjects on a battery of tests, *Manuel* concluded that there is no one psychophysical constitution for

talent in drawing, the essential characteristics varying with the type of talent possessed (26, p. 132). *Dreps* also employed the test method using 27 subjects divided into three groups, artistic, average and non-artistic. She concludes, "Summarizing the factors that seem to differentiate the very artistic individual from others in psychophysical equipment, results from this study seem to indicate that the artistic group had a finer sense of proportion, a greater ability to see relationships, greater flexibility of muscular co-ordinations, a higher degree of emotional sensitivity, an indication of an earlier interest in art, and a richer background of inherited tendencies." (Quoted from thesis.)

For the purpose of determining the psychophysical traits of the two groups of subjects in this study the test method was selected, hence the results of the studies of *Manuel* and *Dreps* not only furnished suggestions as to the capacities and abilities to be considered but as to tests for their measurement. With subjects at the child level, however, the present problem involved the devising of new experimental techniques, as well as the adaptation of those available for older age-groups.

II. Description of tests. In choosing and devising tests to be administered to the artistic and non-artistic subjects, an attempt was made to secure stimuli that would arouse the functioning of the various processes which might be involved in artistic creation. The battery of tests selected may be divided into two groups, those of the sensory and motor capacities, and, in the second and larger group, those based on the perceptual functions, involving re-presentation rather than mere presentation as in sensation and perception.

Sensory and motor tests. Under the first classification were included the following: (1) tapping, and (2) aiming, sub-tests of the Michigan Non-Verbal Series devised by *Greene* (11), (3) aiming test described by *Whipple* (34, pp. 147–151), and (4) recognition of color, a sub-test of the *Lewerenz* Tests in Fundamental Abilities of Visual Art (17). With the group of motor tests it was planned to determine the individual's equipment for the technical side of production, that is, for the act of drawing or painting itself.

In the first test a measure was obtained of motility or speed of voluntary movement of the simplest type and in the second of a more complex type of motor capacity, precision or control of voluntary movement. In the tapping test as presented, the subject taps as fast as possible for 10 sec. with the right hand in each of three squares and then with the left hand in three squares. The aiming test material consists of rows of small circles, 5, 3 and 1 mm. in diameter, into each of which the subject must put a single dot, two periods of 60 sec. being allowed for each hand. The *Whipple* Aiming Test, in which the subject makes thrusts at a series of ten crosses or targets irregularly arranged, calls into action chiefly the larger muscles concerned in whole-arm movement, rather than the finer muscles of hand and fingers used in the *Greene* test.

In this group may also be considered another test, visual memory of proportion, one of the *Lewerenz* series, which is difficult of classification. While the test is one both of memory and motor co-ordination, the author states that in the earlier years success seems to be dependent upon motor skill (17, p. 8). The subject is allowed to observe a black vase form mounted on a white background for two minutes, after which he is asked to draw the sides of the vase from memory. The top and bottom lines of the vase are printed on the test blank.

The test of recognition of color measures sensitivity to color or acuteness of color discrimination, success depending in large part on the natural efficiency with which the eye functions as a sense-organ. The test is of the multiple-choice type, the subject receiving instructions to select from six standard colors, red, orange, yellow, green, blue, and violet, the predominant color in each of 48 variations of these, including intermediates, tints and shades.

Tests of re-presentative processes. - In the larger classification of tests which deal with the mental materials with which the artist works, memory images, fanciful images, composite images, and observations of immediate objects, were the following: (1) *Heilbronner* Apperception or Object Completion Test (8, pp. 86–91); (2) *Knox* Imagination or Ink-blots Test; (3) orig-

inality of line drawing, a sub-test of the *Lewerenz* test series; (4) *Fernald* Recognition Memory Test (**3**, p. 167); (5) feature discrimination, a sub-test of the Michigan Non-Verbal Series by *Greene;* (6) form discrimination, adapted to this investigation by the writer; (7) recognition of pictorial incongruities, and (8) a series of tests of observation and memory employing cinematographic materials, devised by the writer for purposes of this investigation.

A number of other tests were also tried which in their present form of presentation proved unsatisfactory test material for children at the age levels used. These included selected items from the *Meier-Seashore* Art Judgment Test (**28**) and the McAdory Art Test (**19**), and recognition of proportion, a sub-test of the *Lewerenz* series. *Wellman's* Tracing Path Test, included in the motor series, was not diagnostic for the upper ages.

The *Heilbronner* test consists of a series of illustrations of simple objects, the illustrations in each series ranging from the simple outlines of principal parts of the object to the completed, rather complex picture. The subject's apperceptive ability is determined by the amount of detail which must be presented so that he may apperceive the object as a whole, or in other words, grasp the meaning of the picture. Certain of the items in the original test, such as the old-fashioned graphophone, were omitted because they are not common to the environment of children today and for these were substituted new objects more familiar to the children. The total was thus brought to 12.

The use of ink blots for the provocation of imaginative responses is a classical one. In this study *Knox's* card of six blots was presented to the subjects with instructions to name all the things which each resembled, permission being given to turn the card at any angle. Through the test a measure was sought of the quality or uniqueness of the images aroused rather than of their quantity.

Originality and inventiveness to be manifested in graphic expression, which must conform to a certain pattern laid down by the arrangement of a number of dots, is the fundamental requirement of the line drawing test. The test as administered

was limited to the first five sets of dots from the original test, the numbers ranging from three to seven. The subjects were directed to draw anything they liked which would include the dots in the particular space and to add lines to improve their drawing if desired. In this test, as in the ink-blots test, the subject is provided with stimuli in which are inherent a vast range of possibilities, in this case to be expressed graphically. Creative imagination must function for success in this test since from memory images aroused the child must select the one which will best fulfill the requirements of the test.

In the *Fernald* Recognition Memory Test, acuteness of observation and visual memory are called into play. The subject must observe a series of 10 pictures, representing outdoor and indoor scenes, with sufficient care to be able in a later presentation of the same to distinguish them from 10 other pictures with which they are intermingled and which differ from them only in a single important feature. The test was conducted according to the standard procedure for measuring recognition memory, with 5 sec. allowed for the exposure of each of the original pictures.

In the feature discrimination test, accuracy of observation is ascertained in comparing a set of simultaneously presented stimuli, a number of funny faces identical except for the alteration of one feature, and in then determining this variant item. Each face has four features, hair, eyebrows, eyes, and mouth, which vary in a random order in size, direction, curvature, and in the case of hair, number. The faces are arranged in rows and comparisons are called for between rows of two, three and five faces.

As a measure of ability to apprehend total form, which has been conceded to be of major importance for artistic performance (26, p. 115), a test was prepared consisting of a series of drawings of various objects conforming to typical shapes. The subject was required to indicate the main shape of each by pointing to the one of 13 different shaped blocks which it most closely resembled. A picture of the face of a clock was used as a practice item. In the regular series of 25 pictures which represented quite a range of complexity, were an evergreen fir tree,

a crab, oval and circular faces, an owl, a pig, *etc.*, some of the items being adapted from *Kirkwood's* test of learning (16). The block shapes included a triangle, circle, oval, square, rectangle, star, and a number of variations of these. For success with this test the subject must be able to disregard minor detail and perceive the fundamental form of the object depicted.

In order to test keenness of observation in a single situation with unlimited time given for response, use was made of a puzzle-picture of the interior of a living room, in the drawing of which a wide variety of mistakes had been made intentionally by the artist. The errors included such things as the incorrect hanging of pictures, the use of two different designs on the same piece of furniture, the omission of various parts of the furniture, *etc.* These errors were of such a nature that it was felt that practically every child would have had an equal opportunity on the basis of experience to detect them and also that they were of sufficient number and range of complexity to tap the ability of the most observant.

III. Observation and memory test series. Since completeness of observation, the "ability to see," has been repeatedly pointed to as fundamental for success in art both by experimenters in the field (4) and by art educators (36) a special series of tests was devised for its measurement, as well as for the measurement of memory of observed materials. This latter factor is an integral part of the process as the child must not only see, but retain and recall, the various visual pictures which he has formed, perhaps only for a short period of time if the memory images are to be put to immediate use, or over an indefinite period. (13)

For these tests it was desired to present a continuous stimulation such as the child would experience in an ordinary life situation, where he gets what might be called a kaleidoscopic view of events and objects in his environment. The motion-picture situation was selected as the one most closely approximating these requirements. The use of motion pictures also provided possibilities for adequately controlling variable factors, such as the time of exposure and the matter of repeatability of the test in the same manner on every occasion, in so far as the mechanical presentation of the material is concerned.

The reels selected were two two-minute cinegraphs, *Sweepstakes,* designated as reels I and II, and two four-minute movies from a series featuring " Snap," the gingerbread man, *In Wildest Africa* and *Out West,* designated as reels III and IV. The cinegraphs were made especially for children and therefore possessed inherent interest and appeal for the subjects. The characters which they presented were also new to the children in this

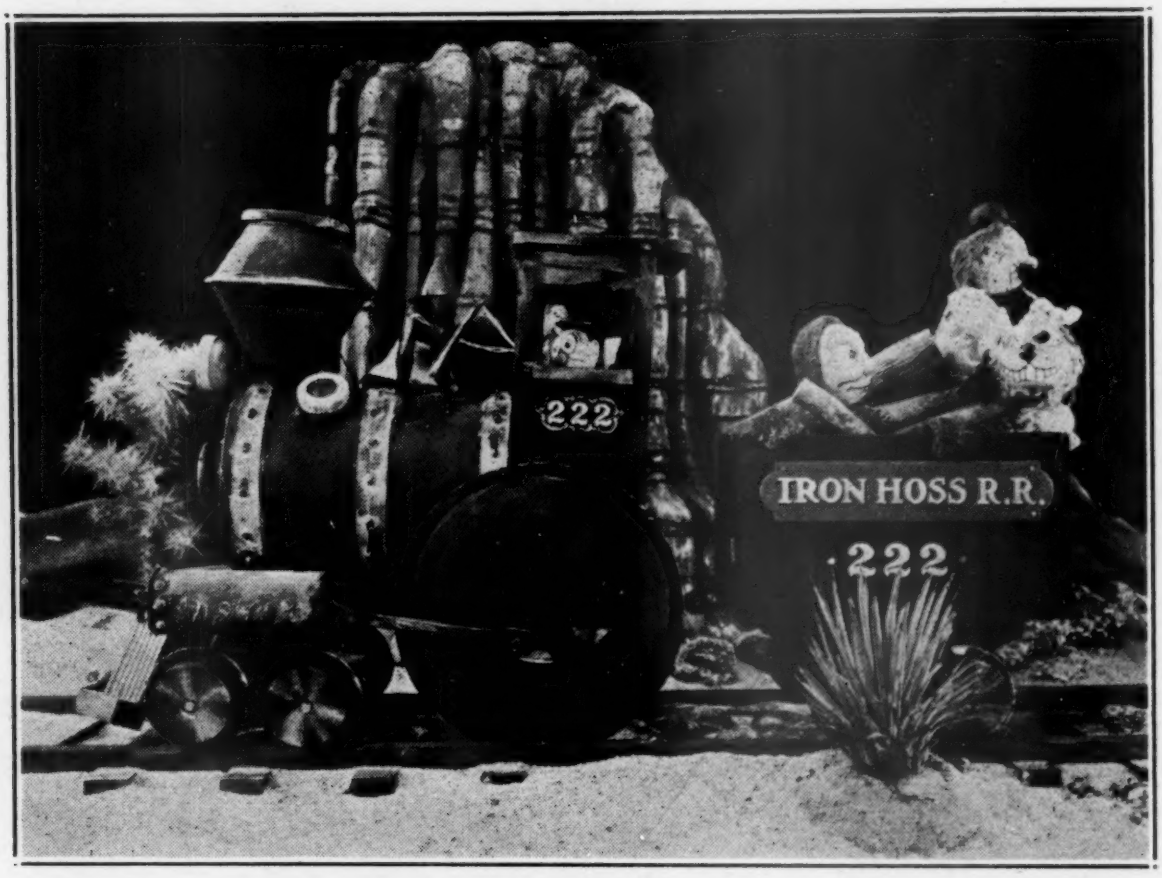

FIG. 1a. Section from " Out West " (Courtesy Eastman Kodak Co.)

situation, hence the factor of previous experience with the test materials was under control. The reels were also of such a length as would permit an examination following without fatiguing the child.

Procedure. Immediately after the presentation of the first three reels, which were shown on separate occasions, the subject was taken to the testing room where he was asked first to recount all that he had seen in the picture. This was followed by interrogation on all points which the subject had not included in his own recital. Questions which covered every possible element

observable in the picture and which were stated in terms comprehensible to the child were formulated for each reel and reduced to typed form, identical for each interrogation.

This combination narrative-questionnaire procedure was arrived at after four preliminary trials with reel I in which 12 children ranging in age from 62 to 88 months, the approximate age-range of the regular subjects, were used as subjects. In the

FIG. 1b. "Still" from "Sweepstakes" (Courtesy Eastman Kodak Co.)

first of these preliminary trials a combination oral completion and questionnaire form was used. This proved to be too indirect, the child frequently failing to comprehend what the examiner was requesting him to do and also losing the sequence of the story. It was decided to make use of definite questions and to introduce prior to these a spontaneous report which would give the child an opportunity to tell his own story, presenting the events in the order in which he remembered them. In the majority of cases the children were anxious to do this, so that the report furnished an opportunity for establishing rapport and an easy transition to

the formal questioning. This procedure was followed in the second and the remaining preliminary trials which were made for the purpose of revising the statement of the questions. Care had to be exercised in this particular in order to avoid leading questions, *i.e.*, questions which, if asked, would give the child cues to the ones following. This difficulty was eliminated by starring all questions which the examiner was to refrain from asking the child if the question which it logically followed had not been answered correctly. Supplementary questions, placed in parentheses, were also added in a number of instances. These were to be asked if the child seemingly failed to understand the original question.

Through the showing of reel I it was planned to secure a measure of the child's spontaneous observation of both the static and dynamic aspects of the visual stimulation. Since the child was not forewarned concerning the interrogation to follow, but was merely brought into the movie-room to see a picture, his responses, to a considerable extent at least, gave an index to his natural degree of "observingness" and also to the nature of his observations. A delayed recall test was given after ten days to measure retention of the observed materials.

With the showing of reels II and III, the child knew that he was to be questioned following the movie so that his mental set was one of increased attentiveness with "intent to remember." Since the uninstructed type of observation and memory was that which was deemed most important for the study, the situation in reel IV was again changed so that the children on this occasion were not anticipating immediate recall, the instructions being to the effect that they were just to see a movie that day. No immediate report was called for, but a recall test was given ten days later as in the three preceding reels, so that in the case of this reel a measure of the child's natural, spontaneous retentiveness, unaffected by previous report as it was with reel I, was expected. Tests of delayed memory were also given on reels III and IV after a period of six months.

IV. Administration and scoring of tests. Specific instructions for the separate tests, all of which were given individually,

were revised for the child level in those instances where the material had previously been used only with older subjects. Instructions to the subjects for each of the tests follow:

Whipple Aiming Test. "I want you to stand here in front of this piece of paper with the crosses on it. Stand back far enough so that your pencil will just touch the paper when you have your arm out like this." The examiner demonstrates and assists the child in securing the proper distance and also the proper position with his right shoulder (for the right hand test) squarely in front of the target. *E* then demonstrates the two-beat rhythm which the child is to follow in aiming at the target and drawing the pencil back, saying, "down, back", "down, back" in the rhythm of a metronome set at 138. The child is warned to bring his pencil back each time until it touches the shoulder. After the child has mastered the aiming movement, *E* instructs him as follows: "The game is to see if you can hit right here where the two lines cross (pointing to the center of the first cross on a demonstration target). Let's see if you can." After practice on the demonstration target, *E* instructs the child to do the same thing on the regular blank, beginning with the first cross and continuing through the tenth, then from the tenth to the first, and back again, making a total of three shots at each mark, or 30 trials in all. *E* points out the order to the child. The left hand is tested in the same manner with the child standing so that his left shoulder is squarely in front of the target.

Lewerenz Visual Memory of Proportion Test. "This card has a picture of a vase on it. I am going to show it to you for two seconds, then I will take the card away and let you draw the vase without looking at it." *E* points to the lines on the test blank, saying, "This line is the top of the vase and this one is the bottom. You are to draw the sides of the vase." *E* then exposes the card, saying, "Now look at the vase carefully so you will be able to draw it just as it is."

Lewerenz Recognition of Color Test. *E* places the color chart with the six large squares of the known colors or standards, red, orange, yellow, green, blue, and violet, on the table before the child under the best lighting conditions possible. The first of the smaller squares of color, which represent variations of the six standards, is then shown the child with these instructions, "See this small colored square (pointing) and see these large colored squares (designating the six colors of the chart). I want you to point to the large colored square that this small colored square looks most like." *E* continues the series through the 48 variations. If the child claims that he can not make a choice *E* reminds him that he is to pick the large color that it looks "most like".

Recognition of Pictorial Incongruities Test. "See this picture? I want you to look at the picture carefully and find all the things you can that are wrong in it. Point to the place where there is something wrong and tell me what it is."

Heilbronner Apperception Test. "I am going to show you a picture of something you've often seen. All of the picture isn't there, but I would like you to tell me what it is." Then show the first picture of series 1, the broom. If the response is wrong, *E* says, "I'll show you the next one." *E* then shows the next picture of the series saying, "What is this?" This phrase is repeated at the beginning of each new series and whenever the child hesitates too long. When the response is correct *E* says, "That's right", and then

shows the rest of the series so that the child can see the completed object. At the end of the first series *E* explains that the pictures were all of the same thing except that the first one had just a few lines and the rest had more and more until the picture was finished. Then *E* continues with the second picture saying, "What is this?" or "What is it going to be?"

Fernald Recognition Memory Test. "I am going to show you these pictures (indicating 10 pictures held in hand). Look at each one carefully as I show it to you so that you will be sure to remember it. As soon as I've shown you all of these I am going to mix them in with these other pictures (indicating pictures on table) which you have not seen. Then I will put them all out on the table and have you pick out the ones I am going to show you now. Do you understand?" *E* exposes the pictures at the rate of one each five seconds. After the 20 pictures have been mixed and placed on the table, E says, "Pick out the pictures you are sure I showed you before."

Knox Imagination Test. "See this card? There are some blots on it made with ink. They aren't pictures of anything, but the game is for you to tell me all the things you think they could be (look like). You can turn the card any way you like. Do you understand?" *E* points to the first blot, saying, "What could this be?" Encourage the child to give all the responses for a blot which he can, by saying, "What else could this be?" *E* takes the blots in order as they are numbered on the card. If the answer given by the child is not clear to *E* he should ask the child to point it out in the blot.

Lewerenz Originality of Line Drawing Test. "See these three dots (designating those in the first square)? I want you to draw something for me and have (include) these three dots in the drawing. You can draw anything you like and use as many lines as you like to make the drawing look nice, but be sure you use all the dots. When you finish I want you to tell me the name of your drawing."

Form Discrimination Test. *E* arranges the blocks on the table in three rows in front of the child, while saying, "I want you to look at the shape of each of these blocks carefully as I put it on the table." The blocks are placed in a random order. *E* then shows the first picture, the clock, saying, "The shape of this picture is like one of the blocks. Look at the picture and look at all the blocks, then point to the block which the shape of the whole picture is most like."

Observation and Memory Test Series (Immediate Recall). Immediately after the showing of the reel the child is taken to the testing room. *E* then says, "You liked the picture, didn't you? I want you to tell me all you can remember about it." After the child has apparently finished his recital urge him on with, "What else can you remember?" When he has completed his story, *E* says, "I am going to ask you some questions about it now." The questions are to be asked as stated in the record form. It is not necessary to ask the questions which the child has already answered in his report, but, where advisable, *E* may repeat his answers to maintain the sequence of the story. It is permissible to repeat a question when the child's answer indicates that he did not get its full implications. In cases where there are supplementary questions these may be used to clarify the meaning. Definite answers should be called for where these are required in the scoring, and where descriptions are to be given E should urge the child to give as complete a report as possible. *E* must have a thorough knowledge of the answers to the

questions in order to get as full a record from the child as possible, but must strictly avoid asking leading questions, *i.e.*, asking a starred question when the preceding one has not been answered satisfactorily.

Delayed Recall. The questions used are the same as those for immediate recall. For the ten day interval the introductory instructions are varied to, "I want you to tell me all you can remember about the last motion picture you saw." In the case of the six-month period *E* says the following: "I would like you to tell me a story today. You remember the motion picture you saw a long time ago about the gingerbread man and his dog. I would like you to tell me all you can remember about it." If the child does not respond he is asked, in the case of reel III, "What were the gingerbread man and his dog doing?" In the case of reel IV, he is asked, "What were the gingerbread man and his dog riding on?" It is necessary to mention the man and the dog in order that there be no confusion with the men in reels I and II.

In the case of the sub-tests from the Michigan Non-verbal Series the instructions given by *Greene* (11) were followed *verbatim.* In no tests except these were time limits set for responses.

Simple, objective methods of scoring were possible in the case of the majority of the tests. Raw scores on the Michigan Non-Verbal Tests were computed as follows: tapping, total number of dots; aiming, number of circles attempted and correctly marked; and feature discrimination, number of rows attempted and correct during the time limits set. Accuracy scores for aiming were determined by dividing the number correct by the number attempted. These raw scores, with the exception of those for accuracy, were converted into z-scores on the basis of Greene's age norms.

The score on the *Whipple* Aiming Test represents the average number of millimeters error in the 30 thrusts at the targets. The test of visual memory of proportion was scored according to *Lewerenz's* method which gives credit only to those sections of the lines drawn which follow more or less exactly the outline of the vase which was to be reproduced. The total possible score is 36.

On the *Lewerenz* Recognition of Color Test the score is the number of colors named correctly, with a total of 48 possible, while on the *Heilbronner* Apperception Test one point is given for each picture named correctly, the total possible being 55. The scores on the *Lewerenz* tests just referred to and on the *Heilbronner* test were all converted into percentages.

In scoring the *Fernald* Recognition Memory Test correction was made for guessing by doubling the number of errors made by the subject, both in the case of those pictures he designated as having seen and those he designated as not having seen, and subtracting this figure from the total number of pictures in the series. This result was divided by the total number of pictures to give a percentage score.

In the case of the *Lewerenz* Originality of Line Drawing Test, it was deemed inadvisable to use the rating sheets presented by the author for scoring the responses, because of the immaturity of the children's drawings and the small degree of differentiation which would result when their work was rated by comparison with samples of the work of older subjects. Using as the basis of judgment the same fundamental criterion as that of the original scoring system, namely, the quality of the ideas expressed in the drawings, five judges were requested to assign values ranging from zero to five to each of the drawings made by the subjects by inter-group comparisons. The average of all the values thus assigned to the drawings made by a subject was his final score.

The coefficient of reliability for this method of scoring was found to be .96 as determined by correlating the average of two raters against the average of two other raters and from the r obtained, which was $.91 \pm .06$, computing the reliability which would be expected with five judges by means of *Spearman's* prophecy formula (9, p. 271).

In scoring the imagination test responses, it was found necessary to formulate a method of scoring which would take into consideration the qualitative nature of the responses, which the usual methods of computing the average or taking the total responses do not do. As in the case of the originality of line-drawing items, use was made of a rating scale with values ranging from zero to five, representing increasing degrees of uniqueness and imaginativeness of response, with appropriateness to the blot as a consideration. To introduce as much objectivity into the scoring as possible, a list of the responses of 50 children was compiled, showing the frequency with which the various answers were given. These data were furnished the raters with the

instruction to interpret a high frequency for any item as an indication of low or average originality, the higher the frequency the lower the originality. The average of the values assigned by five judges was taken for each response and in the scoring of each subject's responses, all scores made on each blot were averaged.

The reliability of the judges' scoring when the average of two judges' ratings was correlated with the average of two other judges was .71±.03, with a reliability of .92, obtained for five judges by *Spearman's* prophecy formula. These correlations may be interpreted as indicating a "true" correlation lying somewhere between .71 and .92.

For the form discrimination test the score was the number of pictures the main form of which was correctly identified by the subject. This was converted into percentage by dividing by the total possible which was 25. In the test of recognition of pictorial incongruities the total number of actual errors found by the subject was computed to secure the final score, no penalty being given for the naming of errors which did not exist.

Complete instructions for scoring answers to the questions asked on the four motion picture reels of the observation test-series were formulated, using as a basis stenographic records taken during preliminary showings of the pictures. For the majority of the questions a score of one was given for the correct answer and zero for no answer or an incorrect one. In the case of a number of questions, however, where varying degrees of completeness of response were possible, higher scores of two, three or four points were assigned for the best answers, with part credit given for inferior ones. The number of points made on each reel was computed and converted into percentage. The total points possible on the respective reels were as follows: I, 44; II, 33; III, 81, and IV, 65. The reliability of scoring, as computed by the rank-difference method (9, p. 190), was found to be .99±.01, when the responses of 16 subjects on the test of immediate recall for reel I were scored independently by two individuals.

V. Subjects. The artistically superior and artistically inferior subjects to whom the battery of tests was given were the same

as those used by *Rodgers,* including children who had attended the Merrill-Palmer School in Detroit, as well as the Iowa City group from the Iowa Preschool Laboratories and the Iowa University Elementary School, also studies by *Grippen* and *Dow.* The method of selection of Iowa City and Detroit subjects devolved fundamentally on two criteria: (1) ratings by art teachers and assistants who had had contact over a period of years with the groups from which the subjects were chosen, and (2) by evaluation of their drawing and painting products. Further criteria used in the case of the Iowa City group were scores on the items of the *Kline-Carey* Drawing Scale and the evaluation of 18 art exercises. A more detailed treatment of the selection of subjects is given by *Rodgers* (30) and *Grippen* (13).

No cases under the age of five years were included because of the impossibility of differentiating varying grades of merit in the art products of younger children who are in the stage when muscular activity is the prime motive for "art" work.

While the subjects used in this study were limited in number, including 11 artistically superior and 12 artistically inferior children, they represented two highly selected groups. An increase in the number of subjects chosen from the two schools, while yielding advantages for statistical treatment, would perforce have decreased the degree of selectivity of the groups and reduced the validity of the findings. The small number also made possible a more intensive study of the capacities and abilities of the subjects.

Table I gives the list of subjects with their sex and their intelligence quotients, chronological and mental ages at the beginning of the period in which the major part of the testing program was conducted, March, 1932, in the case of the Iowa City subjects, and September, 1931, in the case of the Detroit group. Code names were assigned the subjects, the initial letters, X and Z, indicating artistically superior and artistically inferior respectively, and the letter Y, average. The intelligence quotients were obtained from Stanford Binet tests given on dates closely approximating those of the tests administered in this study. For

subjects, XAW, ZAT, ZOW, and ZUW, to whom Stanford Binet tests had not been given, equivalent IQ's from intelligence tests administered by the Detroit schools were used.

TABLE I. *Data showing sex, intelligence quotients, chronological and mental ages of subjects*

Iowa City Group

Subj.	Sex	IQ	CA	MA	Subj.	Sex	IQ	CA	MA
XAJ	F	132	5–2	6–10	ZAV	M	141	5–2	7–3
XAR	M	142	5–3	7–5	ZAG	M	120	6–3	7–6
XAM	M	140	6–3	8–9	ZEW	M	114	6–8	7–7
XAP	F	120	6–11	8–4	ZIW	M	111	6–10	7–7
XAB	F	130	7–8	10–0	ZAS	F	113	7–3	8–2
XIB	F	125	7–9	9–8					

Detroit Group

Subj.	Sex	IQ	CA	MA	Subj.	Sex	IQ	CA	MA
XAG	F	128	5–9	7–4	ZAR	M	134	6–3	7–7
XEB	F	127	6–7	8–4	ZAT	M	122	6–5	7–9
XEW	F	120	6–11	8–4	ZAM	F	130	7–6	9–9
XAW	F	114	7–2	8–2	ZAO	F	110	7–7	8–4
XAS	M	116	8–9	10–2	ZOW	F	110	8–8	9–6
					ZUW	M	110	8–8	9–6
					ZAW	M	105	10–1	10–7
X—A.M.		127	6–9	8–6	Z—A.M.		118	7–3	8–5
S.D.		11	1–1	11	S.D.		10	1–3	1–1

Since the artistically superior group of subjects had a higher mean IQ than the artistically inferior group and the proportion of boys and girls in the two groups was unequal it was necessary to introduce a group of control subjects in order to check on the possible influence of these variable factors on the test results. The method of pairing was used in composing the control group, that is, each artistically superior child was paired with another child of the same sex and approximately the same IQ, chronological and mental age. It was possible to pair five of the artistically superior children with five artistically inferior, but for the six remaining superior subjects it was necessary to use subjects of average artistic ability. The control group therefore did not represent a definite contrast ability group, but it was composed of subjects of less artistic ability than the superior group and approximately equal to it in other respects. Data on the subjects of average artistic ability used in the control group

are given in Table II. The artistically inferior subjects included in the group were ZAV, ZAS, ZAM, ZUW, and ZAO, data on which are given in Table I.

TABLE II. *Data on average subjects in control group*

Subj.	Sex	IQ	CA	MA
YAM	F	130	5–5	7–1
YEM	M	150	6–5	9–7
YAS	F	126	6–6	8–2
YEP	F	116	7–10	9–1
YES	F	129	5–8	7–4
YIS	F	126	6–6	8–2

Group data for the control group were as follows: Mean IQ, 126; sigma, 11; mean CA, 6-9; sigma, 1–1; mean MA, 8–5; sigma, 11.

The observation test series, as well as the form discrimination and recognition of pictorial incongruities tests, were administered to the Iowa City subjects only. In the case of these tests the groups to which the cinematographic observation series, given beginning in March, 1932, and the other two tests, given a year later, were somewhat dissimilar because of a few additions to and eliminations from the original group due to inaccessibility of subjects and additional ratings.

Data on the group of 18 subjects used for the first of the observation test series are given in Table III. Because of the inaccessibility of certain of the subjects for testing with reels II, III, and IV, it was necessary to eliminate subjects XAB, XAH, ZAD, ZAJ, ZES, and ZET. Data on the remaining sub-

TABLE III. *Data on subjects used in observation test series*

Subj.	Sex	IQ	CA	MA	Subj.	Sex	IQ	CA	MA
XAR	M	142	5–3	7–4	ZAV	M	141	5–5	7–8
XAJ	F	135	5–5	8–4	ZAD	F	123	5–6	6–9
XAM	M	140	6–3	8–9	ZAG	M	120	6–3	7–6
XAH	F	122	6–4	7–9	ZEW	M	114	6–8	7–7
XAP	F	120	6–11	8–4	ZIW	M	111	6–10	7–7
XAB	F	130	7–8	10–0	ZED	M	133	6–10	9–1
XIB	F	125	7–9	9–8	ZAS	F	113	6–10	8–2
					ZET	M	138	7–7	10–6
					ZAJ	F	122	7–8	9–4
					ZAH	M	117	8–6	9–11
					ZES	F	101	9–1	9–2
X—A.M.		131	6–6	8–6	Z—A.M.		121	7–1	8–6
S.D.		8	10	1–0	S.D.		12	1–1	1–2

jects were as follows: superior—mean IQ, 132; sigma, 9; mean CA, 6–4; sigma, 11; mean MA, 8–4, sigma, 10; inferior—mean IQ, 121; sigma, 11; mean CA, 6–10, sigma, 10; mean MA, 8–3, sigma, 10.

To form a control group for the artistically superior subjects to whom the immediate recall test for reel I was given the following inferior and average subjects were used: ZAV, ZET, ZAJ, ZAG, YAN, YIP, and YOP. Data on these inferior subjects are included in Table III. The sex, IQ, chronological age, and mental age for the remaining subjects were YAN—F, 5–8, 7–6; YIP—F, 140, 5–11, 8–3; YOP—F, 122, 6–10, 8–4. Means and sigmas for the control group which closely approximated those of the superior group were as follows: mean IQ, 131; sigma, 9; mean CA, 6–6, sigma, 10; mean MA, 8–5; sigma, 1–0.

For the tests of form discrimination and recognition of pictorial incongruities, a group of 14 subjects, six superior and eight inferior, was used, as well as a control group of six average subjects. Data on these subjects are given in Table IV. With the control group pairing on the basis of sex was not possible in all cases. This same was true with the control group for the observation test.

TABLE IV. *Data on artistically superior and inferior subjects and control group for form discrimination and incongruities tests*

Subj.	Sex	IQ	CA	MA	Subj.	Sex	IQ	CA	MA
XAJ	F	149	6–5	9–5	ZAV	M	131	6–5	8–5
XAH	F	122	7–5	9–1	ZAG	M	120	7–2	8–7
XAM	M	140	7–2	10–0	ZEW	M	114	7–8	8–9
XAP	F	120	7–11	9–6	ZAJ	F	122	7–8	9–4
XIB	F	125	8–9	10–11	ZIW	M	111	7–10	8–8
XAA	F	116	7–11	9–2	ZED	M	133	7–10	9–5
YAL	M	147	6–8	9–9	ZAH	M	117	8–9	10–3
YAI	F	140	7–5	10–5	ZES	F	101	9–1	9–2
YER	M	124	7–6	9–5	YIP	F	115	8–0	9–2
YAT	F	122	8–6	10–4	YEP	M	123	7–5	9–1
X—A.M.		129	7–7	9–8	Z—A.M.		119	7–9	9–1
S.D.		10	9	8	S.D.		10	10	7
Y—A.M.		129	7–7	9–8					
S.D.		11	7	6					

VI. Results. Quantitative results on the tests are given in Table V which presents the mean scores of the artistically

superior, artistically inferior and control groups with the differences between those of the artistically superior and inferior and of the artistically superior and control groups.[1] The significance of the differences of these means was determined by the formula given by *Fisher* (7, p. 109) for such computation with small samples. This formula is as follows:

$t = \frac{\bar{x}-\bar{x}'}{s}\sqrt{\frac{(n_1+1)\,(n_2+1)}{n_1+n_2+2}}$, where $\bar{x}$ and $\bar{x}'$ equal the averages of the two samples, n_1+1, the number of cases in one sample and n_2+1 the number of cases in the second. The difference between $\bar{x}$ and $\bar{x}'$ is divided by its standard error as estimated and the error of the estimation allowed for by entering the table for P, which gives the chances in 100 that the difference is not significant, with n equal to the number of degrees of freedom available for estimating s, that is, the total number of subjects minus 2. P of .05 or less is interpreted as showing that the difference between the means of the two samples is significant.

The supplementary test of determining the significance of the difference between the variances was not used. *Fisher* states that the theoretical possibility that a significant value of t should be produced by a difference between the variances only, seems to be unimportant in the application of the method to experimental data (7, p. 108).

As Table V shows, differences between the artistically superior and inferior groups in the case of the various motor tests and the tests of visual memory of proportion, recognition of color and recognition of pictorial incongruities were small and statistically insignificant. For the remainder of the tests a significant difference in favor of the artistic subjects was found to exist between the means of the two groups, P indicating degrees of certainty varying from .05 for the apperception test to less than .01 for the imagination, originality of line drawing, form discrimination and certain of the motion-picture observation tests. In the observation test series the largest and most significant

[1] Individual scores on all tests administered are on file in the University of Iowa Library.

TABLE V. *Comparative quantitative measurements of the artistically superior, artistically inferior, and control groups*

Function tested	Nature of Score	X A.M.	Z A.M.	C A.M.	Diff. X–Z	P	Diff. X–C	P
1. Tapping (Greene)								
Rt. hand	Z-score	0.30	0.10	—0.06	.20	.6	.36	.4–.3
Lt. hand	Z-score	—0.21	—0.07	0.01	.14	.6–.5	.22	.7–.6
2. Aiming (Greene)								
Speed Rt. hand	Z-score	0.32	0.34	—0.05	.02	.9	.37	.2
Lt. hand	Z-score	0.00	—0.43	0.15	.43	.4–.3	.15	.8–.7
Accuracy Rt. hand	% correct	.91	.91	.93	.00		.02	.7–.6
Lt. hand	% correct	.67	.68	.72	.01	.9	.05	.5–.4
3. Aiming (Whipple)								
Rt. hand	mm. from target	6.02	8.68	8.19	2.66	.2–.1	2.17	.2
Lt. hand	mm. from target	8.13	10.38	9.46	2.25	.4–.3	1.33	.5
4. Visual memory of proportion	% correct	.14	.15	.11	.01	.9–.8	.03	.4–.3
5. Recognition of color	% correct	.74	.75	.71	.01	.6	.03	.2
6. Recognition of pictorial incongruities	no. of errors found	18.16	12.14	12.17	6.02	.1	5.99	.2
7. Apperception	% correct	.60	.51	.55	.09	.05	.05	.3–.2
8. Imagination	values from 0–5	2.21	1.88	1.83	.33	.01	.36	.01
9. Originality of line-drawing	values from 0–5	2.62	1.12	1.52	1.50	.01	1.30	.01
10. Recognition memory	% correct	.66	.49	.56	.17	.02	.10	.2–.1
11. Feature discrimination	Z-score	0.58	—0.19	—0.16	.77	.02–.01	.74	.05–.02
12. Form discrimination	% correct	.84	.52	.64	.32	.01	.20	.01
13. Observation with immediate recall								
Reel I	% correct	.61	.35	.42	.26	.01	.20	.05
14. Observation with intent to recall								
Reel II	% correct	.46	.28		.18	.1–.05		
Reel III	% correct	.62	.50		.12	.3–.2		
15. Delayed recall after 10 days								
Reel I	% correct	.65	.34		.31	.01		
Reel II	% correct	.40	.26		.14	.3–.2		
Reel III	% correct	.64	.41		.23	.05–.02		
16. Delayed recall without immediate recall								
Reel IV	% correct	.51	.31		.20	.05–.02		
17. Delayed recall after 6 mos.								
Reel III	% correct	.23	.09		.14	.01		
Reel IV	% correct	.27	.07		.20	.01		

difference was disclosed in immediate recall following the un-instructed observation in reel I, showing that the normal amount which the artistic child assimilates from the visual stimulation afforded by his environment is considerably greater than that of the non-artistic. The importance of the memory factor is also demonstrated in that statistically reliable differences were found for all of the delayed recall tests, with the exception of reel II, although in the case of reel III, where the subjects were prepared to observe in a test situation, the difference only approached significance for immediate recall. Results for the delayed recall on reels III and IV after six months are suggestive only since the tests have not been completed for all of the subjects, but they indicate that differences between the artistic and non-artistic groups become greater over an extended period of time, their ability to retain their visual impressions being superior. Reel II did not prove as satisfactory for the test material as the remainder of the reels because of the seeming obscurity for the children of certain portions of the action. This reduced the number of correct responses of the subjects and limited the possibilities for differentiation in scores. The results obtained with the unmatched superior and inferior groups were substantiated with two exceptions by those resulting from a comparison of the mean scores of the superior and control groups where the effects of sex, IQ, chronological age and mental age had been ruled out in so far as possible by pairing the subjects. The two exceptions were the Heilbronner Apperception and Fernald Recognition Memory tests, for which the differences in favor of the artistically superior group were small and according to Fisher's formula, not statistically significant. With the superior and inferior groups, the differences in the case of these tests had been relatively small and had yielded P's at the limit set for statistical significance, so that it is highly probable that no true difference exists in favor of the artistically superior.

When the superior and control groups were compared, no significant differences were again found in the case of the motor tests, the recognition of color and incongruities tests. In the

case of the motor tests differences were small and in some cases favored the superior and in others the control group, indicating that they were no doubt due to chance. In the tests of imagination, originality of line drawing, form discrimination, feature discrimination and observation with immediate recall on reel I, the only one of the observation test series for which a check with a control group was made, significantly higher mean scores were again made by the artistically superior group.

Comparing test scores of members of the pairs separately verifies the findings with the use of the group means. For those tests which proved significant each of eight or nine of the superior subjects scored higher than his control subject. For the remaining tests which did not prove significant the superior subjects made higher scores than their control subjects only slightly more frequently and in one test, accuracy of aiming with the left hand, more of the control group made higher scores.

The results of this study with children are for the most part in agreement with those reported by *Manuel* and *Dreps* who worked with older subjects. *Dreps* found very small differences between the artistic, average and non-artistic groups on the motor tests and also on the test of color sensitivity. In discussing the specific results of her study she states that the element of color sensitivity does not stand out as being a characteristic factor confined to people having superior ability in art (**4**). *Dreps* also found no significant specific differences in the memory and recognition tests, which are similar to the tests of apperception and recognition memory used in this study.

With the ink-blot test significant differences did not show up in *Dreps'* results. This disagreement with the findings of the present study is in all probability due to the difference in the method of scoring. *Dreps* took into account only the number of responses given while in this study the scoring was on a qualitative basis.

A definite superiority of the artistic group was found in the case of originality of line drawing as in this investigation. *Dreps'* study also indicated that keen observation was an impor-

tant quality of the superior subjects. *Manuel* also states that the tests of observation which he used appear to have some diagnostic value for talent in drawing. The tests of observation used in the *Manuel* and *Dreps* studies were more limited in their scope than the experimental series used for the measurement of observation in this investigation.

The results of this study are also confirmed by the consensus of opinion of 30 artists of standing who were interviewed.[2] Particularly is this true in the case of the motor tests, the group as a whole having expressed doubt as to the importance of motor capacities and abilities for success in art.

VII. Summary and conclusions. This investigation was undertaken to determine experimentally the psychophysical traits in which superior development characterizes the artistically superior as opposed to the artistically inferior child. The subjects were 11 artistically superior and 12 artistically inferior children ranging in age from 5 yrs. 2 mos. to 10 yrs. 1 mo. While limited in number they were highly selected on the basis of extensive ratings and the evaluation of their actual art products.

For the purpose of measurement, test situations were used that would stimulate the functioning of the various sensory, motor, and higher mental processes which analysis indicates to be involved in artistic expression. A special series of laboratory measures of completeness of observation and memory using a cinematographic technique was devised by the investigator, as well as tests of form discrimination (adapted) and recognition of pictorial incongruities.

Since the artistically superior group had a higher mean IQ than the artistically inferior group and the proportion of boys and girls in the two groups was not equal, it was necessary to check on the possibility that these variable factors were causing the differences in mean scores on the tests used rather than artistic ability, the variable under consideration. This was done by the use of a control group composed of subjects of inferior and

[2] The group included artists from New York, Toronto, Taos, Sante Fé, Laguna Beach, Carmel, and Monterey.

average artistic ability, each of which subjects was paired with an artistically superior child on the basis of sex, IQ, chronological and mental age. The differences between the mean test scores of the artistically superior and control groups were compared in the same manner as those between the superior and inferior groups to determine whether similar differences existed with the variable factors under control.

Results indicate that artistically superior children as compared with the artistically inferior show superior performance in the following functions, in so far as these are measured by the tests used: (1) completeness and accuracy of observation, (2) recall of the observed materials after intervals of ten days and six months, (3) uniqueness in imaginal construction of objects and situations from meaningless forms, (4) originality as expressed in line drawings, (5) form discrimination or apprehension of the main form of objects, and (6) feature discrimination involving observation and comparison to determine variant items in a series of visual stimuli.

Differences found in favor of the artistically superior group on tests of recognition memory and apperception or completion of an object from visual imagery of the whole are of doubtful significance as they were not supported by findings with the control group.

On tests of motility and precision of movement the results indicate that no significant differences exist between artistically superior and inferior children. This is also true in the case of color sensitivity, in which the two groups were practically equal in ability.

These results in general concur with the findings of *Dreps* and *Manuel* and are in general harmony with the views of 30 artists of standing whose opinions were obtained. These sources of confirmation offset to a considerable degree the limitation imposed by the small number of subjects. The highly selective character of the contrasted subjects, moreover, would in a common-sense analysis, argue for a validity that could not be realized in an unselected group.

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THE PSYCHOPHYSICAL CAPACITIES AND ABILITIES OF COLLEGE ART STUDENTS OF HIGH AND LOW STANDING

by

HILDEGARDE FRIED DREPS

Problem. The relation of successful attainment in graphic art to the possession of high degrees of certain psychophysical capacities, such as accuracy of motor movements or eye-hand co-ordination, has been largely a matter for conjecture. Artists themselves are not of one mind on the subject [1] and *Renoir* is occasionally cited as an instance of a successful artist who in his later years was so unsteady in his motor control as to require an assistant to tie the brush to his hand. Yet this case offers no certain evidence in either direction because the factor involved is that of a deteriorated state of skills previously demonstrated to have been of high order.

An *a priori* view would hold that the person of superior ability would possess high degrees of these motor skills and would be endowed with high degrees of *capacities* believed significant for superior performance. To hold a hair-line brush so steadily as to place the high-light on the exact point and no other in an otherwise finished eye in a painted portrait would require, it would seem, a very superior degree of eye-hand co-ordination. Likewise the painting act itself is response to a constantly changing area of color relationships, so that it would be difficult to conceive how the process could function without possession of an unusual color sensitivity.

The problem was two-fold: (a) to discover if certain capacities

[1] The result of a canvass of twenty artists of national reputation by Dr. Meier indicated skepticism rather than support for the assumption that motor abilities, at least, were vital to success. There was a different attitude toward capacities, such as æsthetic judgment, memory for visual form, *etc.*, which were held to be fundamental by eighteen out of twenty.

are closely correlated with success in graphic art, and (b) by using the method of contrast and selecting subjects from both the talented and poor student levels, to discover what psychophysical characteristics these superior individuals possess which are lacking in individuals showing little or no promise.

Historical. Manuel (10), investigated various capacities and abilities of three groups of students selected on a basis of drawing proficiency. Included among his subjects were five college art students chosen by personal interview and by tests for drawing proficiency, eight secondary school students (the main experimental group), and six fifth and sixth grade students recommended by the drawing teacher as exhibiting drawing talent. The tests used by *Manuel* covered general intelligence, the higher thought processes, memory and learning, reading, accuracy of observation, sensory discrimination, general physical and motor abilities, and handwriting and drawing. His conclusions were in general that there is no one psychophysical characteristic for talent in drawing and that, if one individual lacked motor steadiness, he was superior in some compensating skill or capacity. His other principal conclusions follow:

> a. Persons talented in drawing exhibit great individual differences in their psychophysical characteristics.
> b. The motor ability which underlies talent . . . is specific rather than general; talent for drawing does not presuppose a general motor superiority.

Ayer (1) attempted to measure the correlation between drawing ability and proficiency in scientific subjects. Both general classes and the especially talented were subjected to production tests. Four groups were tested with unfamiliar objects, in regard to their abilities in drawing, description, and diagramming. The products were then ranked serially in order of merit by a group of judges. Correlation was then found between memory and drawing, description and drawing, *etc.*

Subjects. Twenty-seven subjects were classified in three groups in order to make a comparative analysis of their abilities. In the first group were nine individuals nominated by the faculty of the Department of Graphic and Plastic Arts as having superior ability, each being referred to by a number to which is

prefixed the letters "SA," as SA-1, SA-2, *etc.* In the second group were nine subjects designated as non-art. A more accurate description for this group would be "artistic status unknown." There is some reason to believe that at least some of the nine under other circumstances might have become sufficiently interested in art to have undertaken the study of it, but so far as their records show, they are simply classed as students in the Liberal Arts College. They will be referred to by the symbol UN (unclassified) and a number. A third group was composed of students rated as having average ability or less.[2] These will be designated as MA-1, MA-2, *etc.* The "SA" and "MA" groups were selected from ratings of students made by five members of the Art Department, each listing the ten best and the ten poorest. From the list submitted the 25 best and 25 poorest were arranged in order of rank, assigning Rank 1 to the person whose total rating was highest. These were then interviewed and final selection made on a basis of interest and availability for the time demand of the program, no one being urged to participate unless he felt so inclined. A number who began the series of tests were unable to complete all of them. Their results are not included. The nine subjects forming the non-art group were volunteers from the elementary psychology classes. The SA group is composed of three men and six women (three sophomores, four seniors and two graduate students), all having grade-point average of 3+. The M group (mediocre to poor) likewise included three men and six women and were all rated as having little demonstrated ability, but two of the nine continuing their work in the Department of Art. The UN (non-art, or unclassified) contained six men and three women, six of whom were sophomores and three juniors.

General procedure. Each subject appeared for a total time of 16 hours, usually at a stated hour each week for 16 weeks. All tests were administered individually in the laboratory room

[2] Owing to the fact that students making poor showings in the Department of Graphic and Plastic Art usually drop out during the first year it was difficult to get really poor subjects among those now registered, juniors and seniors being preferred, since their status is rather definitely established by the time they are thus classified.

assigned to the author. Factors such as fatigue, emotional attitudes and restlessness, were considered and controlled as far as possible.

Functions tested and apparatus used. Artistic capacity is regarded as dependent upon a hierarchy of special capacities and attendant skills. The distinction made by *Seashore*[3] between capacity and ability is adhered to in this study, namely, that capacity refers to "organic equipment required in the process of evolution . . . ability refers to habit or skill acquired through the use of capacity in the life of the individual . . . the distinguishing mark of capacity is that it is elemental . . . a comparatively simple unit . . . relatively independent of age, training and general intelligence." The tests and measurements made on the three classes of subjects were selected with a view toward covering both fundamental capacities and some of the more obvious abilities. Some tests were regarded as providing an index to a general function or group of functions, but no test does more than indicate approximate values of measurement. In several instances several different tests were selected to measure slightly different aspects of the same capacity or ability. The tests and the material or apparatus used are described under the following groupings:

Æsthetic judgment. These measures were designed to measure quantitatively individual differences in æsthetic sensitivity or capacity in order that quality in space-composition might be detected. This is believed by *Meier* (13), *McAdory* (11), and *Christensen* (2) to be fundamental to success in art. Probably innate capacity, richness of environment, and affective experience combine to produce individual difference in performance on these tests. The *Meier-Seashore* Art Judgment Test[4] tests the function through reactions to 125 paired compositions reproduced in photogravure,[5] in which there is an element that has been changed to produce superior and inferior compositional quality. The *McAdory Art Test*[6] employs a somewhat similar

[3] Introduction to Psychology, 225.
[4] Bureau of Educational Research, University of Iowa, Iowa City, Iowa.
[5] Jahn & Ollier "Phototone" process.
[6] Teachers College Bureau of Publications, New York, N. Y.

technique but requires a ranking of four versions of 72 miscellaneous designs from pictures to children's dresses.

Imagination. Used here in a wide interpretation, imagination was tested both in the sense of presenting old material in new forms as well as sampling the individual's "store" of images and applicable ideas usually involved in the process known as creative thinking. *Ink Blot* tests were constructed by selecting from a series of 50 the 20 judged to be open to the greatest richness and variety of association. They were made on heavy manila paper 9 cm. square. In administering, the cards were placed face down on the table before the subject who was directed to turn up the cards one at a time, turning them in any direction desired and list all possible objects suggested by the blocks. A *Pictorial Imagination Test* was adapted from *Rossolimo* which consisted of a series of 25 uncompleted familiar objects as a dog, wrist watch, *etc.* Each of these drawings consisted of broken and unfinished lines suggestive of the subject, and were traced in India ink on separate cards 9 x 5 in. in size. The subject was directed to imagine what the drawing would represent if all the lines were connected. The *Griffits Imagination Test* (**5**) is in three parts. The first required the subject to transpose in imagination one square upon another, each having cross lines within the square, and then report the number of three-, four-, and five-sided figures thus created. Part II requires that figures be divided into a certain number and kind of smaller figures, with report on the ensuing spatial forms. Part III consists of ten problems in which lines are drawn in imagination in triangles or squares with reports on the resulting three-, four-, or five-sided figures created.

Visual memory for form. The tests used in this function were for the purpose of discovering to what extent visual impressions may be remembered and recognized when again experienced in conjunction with new material or new patterns. Tests of this type involve very close discrimination of line, form and color. *Form Recognition Test No. 2* (*Whitley*, **20**, pp. 53–56) consists of two presentation blanks, each with a different series of geometrical forms, and two recognition blanks for

checking the forms recognized. One minute was allowed for exposure, the checking of forms on the recognition blank following immediately. *Whipple's Spot Pattern Test* (19, V. I, 290–296) is designed to measure not only memory capacity but ability to organize the spots into patterns. An adjustable card was placed in the tachistoscope with all the spot patterns arranged on it so that they could be exposed in order without removing the card. Five different patterns were used. The subject located the spot pattern on the plain card and then was referred to a cross-section paper for reproducing the pattern. The exposure was for three seconds. The pattern was re-presented until learned. When this occurred the next pattern was presented. The score was the number of trials taken to reproduce all the spot patterns. *Whipple's Visual Apprehension Test* (19, V. I, 278–290) consists of a card 9 x 7 in. with 20 different figures comprising rectangles, squares, circles, crosses, and triangles arranged in random order which was exposed to the subject for a period of five seconds, after which the subject reported all figures that could be recalled. Ten questions were also presented. The card was re-presented for a period of three seconds and questions re-presented.

Accuracy and steadiness of movement. The *Wellman Tracing Board* (2, 103–105) was used as a measure of the accuracy of voluntary movements of the arm and hand. The apparatus is made of two metal strips about 1 cm. apart at one end of a 25 cm. distance and about 1 mm. at the other end, between which a stylus is drawn, so wired that a contact with metal strip records on a counter. A new trial is begun after each contact. The board was placed in four positions: toward the body, left to right, away from body, and finally, right to left. Five trials were made in each position, the total score being the average distance of all trials. Involuntary movement was tested by the *Whipple Steadiness Plate* (19, V. I, 155–160) being a brass plate mounted on a base with holes of decreasing size, into which a wired stylus is inserted a distance of 6 mm. and held for 15 seconds without touching the periphery of the hole. The subject proceeds from the largest hole. A sounder and counter records failures by bat-

tery current contact. The test was given in both a standing and sitting position, the plate being on a level with the right shoulder. This apparatus is assumed by *Whipple* to provide a measure of the "amount of involuntary movement which appears when the finger, hand, arm, or body as a whole is held as nearly motionless as possible." Discrete voluntary movements of the hand and arm were tested by the *Whipple Aiming Test* (19, V. I, 147–151). This aiming or target test measures the amount of error made in efforts to strike a target consisting of intersecting lines in the form of crosses placed at irregular distances on a sheet of paper 8½ in. x 11 in. mounted on a board, which is placed in a vertical position at shoulder level. Practice trials were allowed on a demonstration target until the proper adjustments were made. The strokes were made with full free arm movements and regulated by metronome beat set at 138. The score was the average deviation of 30 trials measured in mm.

Fundamental abilities of visual art. The test of *Lewerenz* (7) in its various separate sections purports to measure certain fundamental abilities considered highly significant for success in art. Some of these tests were given to measure particular abilities not covered adequately by other measures. These include *recognition of proportion, originality of line drawing, observation of light and shade, analysis of problems in cylindrical perspective, in parallel,* and *in angular perspective,* and *color recognition.* These materials are standardized and available to anyone; no description is therefore needed.[7]

Color sensitivity. The Ishihara Test for Color Blindness and the *Jennings Self-Recording Test* were both given for the purpose of providing a certain check on color blindness, since it is possible that tints on textiles provide a somewhat better test material than tints on paper. These tests are also both available and provide a more or less standard test of color-blindness. In addition, a *Color Recognition* Test, adapted from *Rossolimo* was given. This was in two parts and was constructed of designs in color, with duplicates and 15 others having slight variations in color. The ten stimulus designs were exposed for 1 min. and

[7] Research Service Bureau, Los Angeles.

then removed. The subject was then required to select the 10 duplicates from the pack of 25 cards. In the second part geometrical and linear designs were used. They were also in duplicate form and mixed with designs having slight variations in brightness and shades. The score was the number of correct responses in each test.

Miscellaneous functions. Several aspects of personality believed to be intimately related to artistic nature were investigated. *The Pressey X–O Test of Emotional Reactions* was given and a case study of all subjects was made following a form made up of twenty-five questions touching upon various aspects of heredity, personality, interests, contacts with and progress in art.

General Results of Tests and Measurements

The mean scores by groups for each capacity and ability follow:

TABLE I.

Function or Test	Group S	Group M	Group UN
1. *Æsthetic judgment, combined*	*332.3*	*322.0*	*281.1*
Meier-Seashore Art Judgment Test	105.4	104.4	90.0
McAdory Art Test	196.0	188.0	166.7
Lewerenz (Æsthetic judgment only)	30.9	29.6	24.4
2. *Imagination, combined*	*198.5*	*198.9*	*189.8*
Pictorial imagination	20.0	20.0	20.6
Ink Blots	41.4	46.5	37.5
Imagination, Griffits	137.1	132.4	131.7
3. *Visual Memory for Form, combined*	*126.0*	*117.3*	*118.9*
Form recognition, Test No. 1	9.0	8.8	8.5
Form recognition, Test No. 2	9.4	8.4	8.3
Memory, Test No. 1	18.8	16.8	17.4
Memory, Test No. 2	17.4	15.8	18.1
Spot pattern, Whipple's	18.4	15.8	15.4
Visual apprehension, Whipple's	53.0	51.7	51.2
4. *Accuracy and Steadiness of Movement, combined*	*14.31*	*16.46*	*14.65*
Precision, Wellman Tracing Board	4.10	5.82	4.13
Steadiness, Whipple's (Sitting)	2.37	3.22	2.56
Steadiness, Whipple's (Standing)	3.37	3.22	3.64
Precision, Whipple's Aiming	4.47	4.20	4.32
5. *Fundamental Abilities, combined*	*126.9*	*111.5*	*92.6*
Originality of line drawing	43.1	33.1	25.0
Reproduction of proportion	22.6	18.3	13.5
Analysis of perspective	23.5	21.9	17.9
Color sensitivity	37.7	38.2	36.2
6. *Miscellaneous*			
Emotional sensitivity	195.0	191.0	159.0
Neurotic tendencies	9.3	7.2	6.4
Lewerenz Test complete	189.5	169.5	135.7

Interpretation of Data

1. *Æsthetic judgment.* Æsthetic judgment is believed to be basic to eventual success in art. Hence, theoretically the superior group would stand highest, the mediocre group next, and the unclassified group last. The latter, however, might conceivably include potential artists which would weaken the inference. The combined results, if given the usual interpretation, indicate that these superior art students do have, as measured by these tests, superior æsthetic judgment. The M group is but 10 points less (In *Meier-Seashore* and *Lewerenz* tests, one point only). The unclassified group, on the other hand, is 41 points below the M group and 51 under the S group. It is obvious that a selection of some kind has operated to place those in art classes who greatly excel the average Liberal Arts student in the possession of æsthetic judgment. It is of course to be observed that the combining of unweighted values does not make for accurate comparisons and strictly valid conclusions. This study, however, was primarily a preliminary one and has value chiefly as being indicative of the true situation. This finding was somewhat at variance with that of *Manuel* (10, p. 130) in which he stated "quality of performance in graphic representation and quality of performances in æsthetic judgment are independent or, at least, partially independent variables." His use of the word "performances" would lead to the view that his conception of the nature of æsthetic judgment and that followed in the three tests employed here would be different and it is also to be noted that the three tests used in this study which constituted a more serious attempt at measurement of æsthetic judgment had not yet been constructed when his study was made.

In comparison of test results the *Meier-Seashore* test results correlate .70±.09 with the *Lewerenz;* and the *Lewerenz* with *McAdory* .53±.09. The *Meier-Seashore* test is essentially one of sensitivity to the effect which a composition as a whole makes on the observer; the *McAdory* test requires reactions to a variety of materials embracing furniture, clothing, rugs, and the like, the criterion being established by consensus; while the *Lewerenz* test

is confined to reactions to objects in outline and includes both practical objects and scenes. The three tests therefore draw upon somewhat different classes of reactions, which possibly explains the absence of a higher inter-correlation.

Imagination. The combined scores of the three imagination tests showed comparisons similar to those of the *Meier-Seashore* and *Lewerenz* tests in æsthetic judgment. There was little difference between the S and M groups and the UN group was lower. The Ink Blot tests showed actually higher scores for the M group. The *Griffits* test showed a superiority for the S group but this advantage was not considerable. The test results would tend to suggest that great differences in imagination are probably found in the genius class and that in the university sampling studied it is unlikely that any of this class were included.

Visual memory for form. The combined results showed the S group ahead of the M and UN groups which were on the same capacity level. The condition seems to result from the failure of most of the tests to disclose diagnostic differences among the groups of any marked degree, only the two *Whipple* tests showing any real degree of separation. Either the tests are not sufficiently sensitive or this particular small segment of the population did not exhibit much of a range in the possession of this capacity.

Accuracy and steadiness of movement. As in the preceding group of capacities, this group of abilities showed no obvious superiority for the S group. The superior students exceeded the showing made by the other two groups only in one of the four abilities—precision, but the differences were slight. Since these tests are apparatus tests of a fairly dependable kind the conclusion must follow that there was no considerable measurable difference among the three classes of subjects.

Fundamental abilities (Lewerenz). These are not all true abilities but rather a mixture of abilities and capacities. Those, which are abilities dependent in considerable part upon training, exhibited definitely graded differences from the S group down to the UN group. The one which is nearest to being a true capacity, sensitivity to color, showed no such gradation but rather

a slight superiority for the M group. In this group the effect of training and instructions had undoubtedly played a part, particularly in the second, reproduction of proportion, and in the third, analysis of perspective. The first, originality of line drawing, is perhaps dependent to some degree upon the nature and quantity of early experience but also upon specific neural conditions which would affect the manner in which impressions are received and retained.

Miscellaneous. In emotional sensitivity there seemed to be a distinct preponderance in favor of the two groups made up of art students. Likewise this seemed to hold for neurotic tendencies. The writer believes that the art student type is normally a person of keen perception and of delicate and refined tastes and interests; hence probably more sensitive to the æsthetic world. This greater sensitivity is probably also the factor which prevents superior scores in capacity and ability tests and there is in the superior art student a nervous form of behavior which does not apply to the non-art person.

Certain relationships are shown in the following correlations:

Meier-Seashore with *McAdory*	.49 ± .10
Meier-Seashore with *Lewerenz*	.70 ± .07
Meier-Seashore with *Originality of line drawing*	.50 ± .10
McAdory with *Lewerenz*	.53 ± .10
McAdory with *Originality of line drawing*	.34 ± .12
Originality of line drawing with *Imagination*	.28 ± .12
Originality of line drawing with *Memory of proportion*	.26 ± .13
Originality of line drawing with *Memory for form*	.45 ± .11
Originality of line drawing with *Color sensitivity*	.38 ± .11
Proportion with *Analysis of perspective*	.51 ± .10
Motor abilities with *Meier-Seashore*	—.26 ± .13
Motor abilities with *Lewerenz*	—.24 ± .13
Motor abilities with *Originality of line drawing*	—.22 ± .13
Motor abilities with *Emotional sensitivity*	—.27 ± .12
Color sensitivity with *Imagination*	.34 ± .12

Conclusions

The findings of this study support, in general trend, the conclusions of *Manuel* (10). That these results should fall into the same general trend makes the principal shortcoming of this study, namely, the small number of cases, of less consequence. Yet it is recognized that conclusive results can hardly be claimed until

such time as that when more subjects can be made available and when these subjects can include mature artists of demonstrated ability.

In spite of these limitations there appears to be confirmation of the conclusion suggested by *Manuel* that there is no one psychophysical characteristic that is present in all persons gifted in graphic art and that superior degrees of some skills or capacities may be possessed by individuals not in art. In certain capacities, such as æsthetic judgment or visual memory for form, one may expect normally to find those electing art to have a superior degree. In the other functions there is no apparent advantage enjoyed by the art student so far as indicated by these tests. Prognosis of eventual success in graphic art must therefore be based upon other factors than skills and certain capacities, possibly upon temperamental and attitudinal factors or probably upon the interaction of a high degree of æsthetic judgment with certain combinations of capacities and abilities.

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AN EXPERIMENTAL INVESTIGATION OF THE BASIC ÆSTHETIC FACTORS IN COSTUME DESIGN

by

WILHELMINA E. JACOBSON

I. Introduction. This study aimed to discover the bases of beauty in costume design. Beauty in costume is a problem of interest to many persons, even to primitive man, and to both producer and consumer today. The designer should know what is apt to please the public or afford satisfaction and how beauty may be attained in his design. The consumer, to satisfy his desire for self-assertion, social approval or recognition, distinction or sex attraction, is interested in knowing how clothes may help to satisfy these desires (1, 6, 18).

The problem was suggested originally in observations made by the writer during field-work in Wyoming and Idaho, and in studying the methods of designers in New York, Chicago, and Hollywood. In the first instance during problems in hat-making it was observed that when after a series of trials and errors the women themselves succeeded in shaping the brim or placing the trimming so that it was highly satisfactory to them, a general popularity and expressed admiration by women of the community frequently followed. This popular recognition was all the more certain to come in those instances when all the makers felt agreed upon the pleasingness of the design. In the latter instance, that of designers at work, we observed that they would repeatedly design and erase until they arrived at a result that pleased them. In making the hat or garment they would proceed in a similar manner, changing details many times. Even when proceeding without materials, they selected and rejected, always responding with satisfaction when an objective situation was realized which is usually referred to as one possessing beauty.

Objects and arrangements, therefore, which elicit a pleasant reaction *from people in general* may possess objective factors which satisfy the needs of the organism. A study of these factors in costume design might cast some light upon the nature of beauty. This identification of the beautiful with the satisfying (beautiful, pleasant; ugly, unpleasant) in which there is more or less unanimity among æstheticians (34) holds only for the general nature of the response; specific qualities producing these responses are not agreed upon by æstheticians. *Garth* (23, p. 209) expressed the view, held also by *Santayana* (57, p. 2) and *Tolstoi* (60), that ". . . regardless of the crudity of primitive art or the virtuosity of the art of cultured people there is but one artistic impulse . . . [which] finds its satisfactions in such forms as rhythm, symmetry, unity, climax, contrast, in art of all races." Contrary views are represented in *Lund* (37, p. 228) and *Murray* (42, p. 641). This study assumed the view most generally accepted, namely, that the æsthetic experience is shared in by all but in varying degrees (16, p. 28; 62, p. 36).

II. The problem. The general objective of this investigation was to investigate the basic factors underlying beauty in costume or to isolate those objective realities in a given range of costume designs that practically everyone recognizes. The problem was advanced through three phases. The first was a determination of some of the general factors involved in costume or costume design and the development of the necessary techniques. The second was the isolation of factors that are basic or fundamental in the æsthetic impulse. In the absence of a more satisfactory criterion of "basic" quality the thesis was maintained that the consistent concurrence of statistically significant reactions indicates fundamental bases of beauty. The third phase attempted to discover an explanation for the "basic-ness" of these factors. Practically it was an investigation of some of the objective factors responsible for one's preference for the beautiful costume or design and dislike for the one not considered beautiful.

III. First Phase: determination of factors in costume design. A. Preliminary procedure: (1) Wyoming group. To obtain data upon the general factors in costume design, a test con-

sisting of 20 paired designs adapted from designs in *Vogue* (issues from October, 1928, to June, 1929) was constructed. These were made in mimeographed form, one design being a copy of the original, the other having some element altered in such manner as to produce a design of inferior æsthetic quality. This result was usually accomplished by violating the æsthetic principle which might be present. The procedure followed was that of giving each subject a copy of the test, requiring a preference to be indicated in writing and reasons for the choice in each pair. This material was given to 198 women and 126 girls ranging in age from 10 to 81 [1]. Table I shows the per cent of preferences for each of the 20 designs for original (O) and for variation (V).

TABLE I. *Per cent of preferences by 198 women and 126 girls for variation A and B in the case of the 20 designs*

Paired Design no.	Women		Girls		Total	
	O	V	O	V	O	V
1	62	38	74	26	68	32
2	43	57	54	46	48	52
3	10	90	7	93	8	92
4	25	75	15	85	20	80
5	54	46	60	40	57	43
6	51	49	70	30	60	40
7	82	18	86	14	84	16
8	44	56	30	70	37	63
9	30	70	44	56	37	63
10	68	32	69	31	69	31
11	61	39	70	30	65	35
12	28	72	15	85	21	79
13	48	52	39	61	43	57
14	64	36	50	50	57	43
15	63	37	33	67	48	52
16	46	54	69	31	58	42
17	92	8	84	16	88	12
18	22	78	29	71	26	74
19	84	16	83	17	84	16
20	31	69	61	39	46	54

From these data it seems (a) that a high per cent of preference for one design and a low per cent for the variation (as in No. 3) may mean that one is beautiful and the other ugly; (b) that whatever the factor or factors are that operate, they influenced the majority of the observers in a similar manner; (c) that an

[1] Given under auspices of Extension Division, University of Wyoming, at recreation camps.

approximately equal preference (as in No. 2) may indicate that such test items were faulty in not presenting a clear-cut problem. A correlation of women's scores (age-range 18 to 80) with the girls' scores (age-range 10 to 18) yielded .805, indicating that there is a fair constancy in æsthetic reactions.

Nearly two thousand reasons collected at the time the tests were given were analyzed. These fell in categories such as the following:

I. Æsthetic factors
  A. Principles of art
    1. Proportion (.."looks too square...")
    2. Balance ("..makes figure look lopsided"), *etc.*
  B. Resulting attributes
    1. Harmony
    2. Unity
    3. Fitness
II. Economic factor
  A. Utility ("..too dressy and difficult to keep nice")
  B. Construction ("..more carefully made.."), *etc.*
III. Hygienic factors
  A. Comfort ("..look too tight...")
  B. Relation to posture, *etc.*
IV. Miscellaneous

This analysis disclosed weaknesses in the technique used and suggested improvements in the following directions: (a) a more refined technique than mimeographing and (b) better control over the variables—drawing, posture, style, and associations.

(2) Iowa group. Four new types of material were considered (a) variations in actual costume on a person; (b) costume on a model; (c) experimental costumes on twins, using stereoscopic presentation to subject; and (d) historic costume design prepared in line and color. For fairly obvious reasons projects (a), (b), and (c) were discarded and (d) was thoroughly investigated. After considerable search suitable materials were obtained in four "La Mode Feminine" sets[2] comprising 240 design plates 3 in. x 3¾ in., presenting costume from 1490 to 1920 A.D., and including designs of both day and evening costume, indoor and outdoor wear, and warm and cold seasons.

Twenty of these designs were desired for experimental pur-

[2] Kroch's International Book Store, Chicago, Ill.

poses. It was decided to secure these by an elimination process in two stages. The experimenter selected 75 considering (a) her own preference as to beauty,[3] (b) variety of purpose, (c) equal representation from each group, and (d) possibilities of faithful reproduction.

These 75 designs were submitted to 20 judges for evaluation, the judges including one artist, three modistes, six teachers of

TABLE II. *Rank and score of 75 historic costume designs as judged by 20 experts*

Rank	Date of design	Score	Rank	Date of design	Score
1	1710	88	38.5	1810	59
2	1750	87	38.5	1902	59
3	1859	86	40.5	1913	58
4	1920	84	40.5	1916	58
5	1851	82	43.5	1680	57
6	1490	81	43.5	1790	57
7	1720	80	43.5	1822	57
8	1725	78	43.5	1915	57
9	1715	77	47.5	1540	56
11.5	1520	76	47.5	1820	56
11.5	1785	76	47.5	1910	56
11.5	1789	76	47.5	1915	56
11.5	1840	76	50	1910	55
15.5	1690	74	51	1903	53
15.5	1740	74	52	1779	52
15.5	1782	74	53	1912	51
15.5	1804	74	54	1889	50
18.5	1745	73	56	1855	49
18.5	1850	73	56	1861	49
20	1848	72	56	1906	49
21	1635	71	59	1901	48
23	1781	68	59	1906	48
23	1846	68	59	1916	48
23	1917	68	61.5	1670	46
25.5	1645	67	61.5	1904	46
25.5	1914	67	63	1911	45
27	1917	66	64.5	1869	44
28	1811	65	64.5	1871	44
30.5	1765	64	67.5	1894	42
30.5	1775	64	67.5	1904	42
30.5	1853	64	67.5	1912	42
30.5	1907	64	67.5	1913	42
33	1906	63	71.5	1705	41
34	1700	62	71.5	1902	41
36	1857	60	71.5	1903	41
36	1887	60	71.5	1909	41
36	1909	60	74	1650	40
			75	1907	39

[3] Prior education (Universities of Washington, Columbia and Chicago); training and experience (Kurzman Shops, Hollywood studios, Extension clothing expert) supported the competence assumed.

costume design and five students of costume design. The 75 plates, shuffled to appear in chance order, were placed by the method of group-order of merit into five classes: very much liked, slightly liked, indifferent, slightly disliked and very much disliked. The judges were asked to disregard as far as possible color, light and shade, expression as indicated in posture and face, head-dress, and texture. Numerical values were given to the groups from five points for the "very much liked" category to one point for the "very much disliked" class, making it possible for any one costume to attain 100 points if given first place by all 20 judges. Table II gives the rank-placement and score for each of 75 designs.

It should be observed that style was inoperative in affecting the judges. The two most preferred designs are early and middle 18th century designs and that in sixth position is a 15th century costume. Yet 1920 is also represented among the first five!

B. Second preliminary procedure. Thirteen of the best designs and seven of the poorest were selected as representing a typical range and variety of costume and shown by delineascope presentation to 29 university women, including at extremes both freshmen and graduate students. Each design was visible for 30 sec. after which 30 sec. were allowed for the subject to choose one and write down the reasons for the choice. The following instructions were given:

> "A series of 20 historic costume designs will be shown on the screen; you are to state on the paper you have whether you consider each beautiful, intermediate (neither beautiful nor ugly) or ugly, and give your reasons."

The designs were presented in double chronological order as in Table III, which gives a summary of the evaluations and scores attained on a basis of 3 points for a beautiful rating, 2 for intermediate and 1 for ugly; maximum, 87 points; minimum 29. A rank-order correlation between assignments by the experts and the students was .82.

These results indicated (a) that there appear to be certain factors operating which are "sensed" alike by both experts, widely distributed geographically, and university students; (b) that in general certain costume designs give a feeling of

satisfaction while others give a feeling of dissatisfaction (*e.g.*, 1920 and 1894 with scores of 82 and 37 respectively); (c) that there is a considerable degree of agreement in the preferences for some designs and a considerable degree of disagreement in the case of other designs.

TABLE III. *No. of evaluations and score for each design as determined beautiful, intermediate, or ugly by 29 college women*

Date of design	Evaluations			Score			
	Beautiful	Intermediate	Ugly	Beautiful	Intermediate	Ugly	Total
1490	15	7	7	45	14	7	66
1520(10)	13	11	5	39	22	5	66
1902	8	8	13	24	16	13	53
1650	6	10	13	18	20	13	51
1690(19)	17	8	4	51	16	4	71
1903	6	6	17	18	12	17	47
1710(45)	22	7	0	66	14	0	80
1725(33)	9	12	8	27	24	8	59
1907	4	6	19	12	12	19	43
1750(54)	12	10	7	36	20	7	63
1789(37)	6	20	3	18	40	3	61
1909	5	8	16	15	16	16	47
1804	10	9	10	30	18	10	58
1850(41)	5	8	16	15	16	16	47
1912	3	8	18	9	16	18	43
1851(25)	20	7	2	60	14	2	76
1859	14	14	1	42	28	1	71
1917	5	11	13	15	22	13	50
1894	2	4	23	6	8	23	37
1920(21)	25	3	1	75	6	1	82

Legend: The nos. in parentheses refer to the illustrations.

Analysis of the written reports followed the same procedure of the Wyoming reports, classifying readily into the same categories. The same factors appeared to characterize these costumes as obtained in the Wyoming group.

Summary of first phase. Reactions of preference and analysis to costume designs in experimental pairs (Wyoming group) and to historic costume designs presented singly (Iowa group) indicated that definite preferences went with certain designs and definite aversions with other designs. The historic designs were rated according to beauty by 20 experts; reactions to 20 of these submitted to untrained subjects (students) correlated .805 with the experts' rating. The æsthetic factors appeared to be the ones offering most promise of experimental handling and also of most

significance in evaluation of costume design. This preliminary stage suggested the need for refinements in design to make it more amenable to experimental analysis through control of the variables of drawing, posture, style and association.

IV. Second phase: determination of basic factors. In the determination of what factors are basic or fundamental the assumption was made that, in the absence of a more satisfactory criterion of "basic quality," consistent concurrence in statistically significant frequency suggested the fundamental bases of beauty. In the two preliminary studies some factors involved in the general expression of preference were determined. A further analysis of these reasons served to determine, within the limits of this study, what factors may be basic.

A quantitative analysis of the verbal reports given by the Wyoming women and girls was made by determining the frequency of the responses for each category. A quantitative analysis of the verbal reports of the twenty paired designs given by the University of Iowa women was made in the same manner as the analysis for the Wyoming data.

Results. The results of the Iowa reports tended to conform closely to the results of the Wyoming reports. This is indicated in Table IV where the per cent of reasons is given in each study for the various categories.

The fact that 69 per cent of the reasons in the first study and 60 per cent in the second study involve some æsthetic factors seemed to indicate two things: first, that æsthetic factors appear to be basic in one's preference, and second, that, if there are factors other than the æsthetic involved in a preference, they are controlled to a large extent in this type of material and in the method used in the two preliminary studies. Of the principles of art proportion, balance, rhythm and emphasis have been consistently concurred in by all groups.

Method of verification. The analysis of the 2,823 verbal responses of the two preliminary studies was made by the writer. To verify this procedure a representative portion of the reactions was submitted to competent judges for analysis, this portion being

TABLE IV. *Per cent of reasons for each factor in the Wyoming and Iowa data*

Factors	Wyoming Group	
I. Æsthetic		69.0
A. Principles	53.8	
1. Balance	26.2	
2. Rhythm	21.1	
3. Proportion	26.8	
4. Emphasis	18.0	
5. Contrast	0.0	
6. Variety	7.4	
B. Attributes	46.2	
1. Harmony	12.0	
2. Unity	86.0	
3. Fitness	2.0	
II. Economic		1.0
III. Hygienic		.7
IV. Miscellaneous		29.2

Factors	Iowa Group	
I. Æsthetic		60.0
A. Principles	70.5	
1. Balance	14.9	
2. Rhythm	29.1	
3. Proportion	35.4	
4. Emphasis	9.5	
5. Contrast	2.4	
6. Variety	8.7	
B. Attributes	29.5	
1. Harmony	64.6	
2. Unity	25.6	
3. Fitness	9.9	
II. Economic		1.0
III. Hygienic		1.5
IV. Miscellaneous		37.3

taken from the 972 responses in the second study. Duplicate responses were omitted, as were statements that included the terms proportion, balance, rhythm, emphasis, and contrast. These responses were submitted to judges in various parts of the United States, six of whom were teachers in fine arts and five were teachers of costume design. The 212 reactions used were typed and listed in chance order. The instructions read in part:

"...state...the art principle which you think is involved in each reason. If you think it involves a violation of the principle write a minus sign after the letter[4]...if the statement seems to indicate a good use of the principle indicate by a plus sign ... if it involves no principle leave the space blank...."

The judges' evaluations of these responses were analyzed by tabulating the number of items which each had evaluated in

[4] Each principle was designated by letter.

approximately the same way. These results are given in Table V.

TABLE V. *Per cent of items each judge and each of the other eleven judges evaluated in the same way (measure of concurrence)*

	Judges										
	A	B	C	D	E	F	G	H	I	J	K
B	57.4										
C	60.1	50.0									
D	55.5	52.2	44.9								
E	66.5	57.7	53.5	55.2							
F	54.1	45.0	41.2	40.2	48.1						
G	73.1	52.2	56.9	48.5	63.3	47.7					
H	72.4	54.2	55.2	52.4	62.7	56.0	73.8				
I	61.7	51.0	50.7	67.0	61.9	51.1	56.7	60.6			
J	75.1	52.8	55.7	60.2	67.0	55.2	69.9	66.5	60.0		
K	47.8	41.2	42.2	37.0	39.6	37.9	41.6	46.5	49.0	47.5	
L	66.5	53.4	57.2	65.7	65.1	57.8	67.0	67.3		77.2	44.6
Ave. of Total	62.7	51.6	51.6	52.6	58.2	48.6	59.2	60.7	57.0	62.5	43.1	62.1

Summary of second phase. In searching for the basic factors in costume design it was postulated that the factors occurring most frequently in the general population are basic, particularly if these factors should also be concurred in by experts. An analysis of the Wyoming and Iowa data was made and a verification was made by competent judges who interpreted and evaluated a sample of these data. Results indicate that the æsthetic factors have greater weight than the economic and hygienic factors; that certain principles (proportion, balance, rhythm and emphasis) have more weight than others; and that girls tend to be less analytical than mature women. The results of the verification tend to confirm the earlier hypothesis that the artistic impulse is universal in that it finds expression in the terminology of the novice and of the artist and that experts recognize the same meaning in both of these. The results also tend to confirm the hypothesis that beauty is invariably associated with principles of art.

V. Final phase: an investigation of the basic quality of factors. The third stage of the study included an investigation as to why certain factors, such as proportion, rhythm, balance and emphasis, are fundamental in the æsthetic experience. The preliminary experimentation in the final stage was an endeavor to develop and refine test-material. The final experimentation was an effort to

obtain a consensus of expert and non-expert judgment in regard to costume designs of varying degrees of beauty as determined in a trial experiment. It was believed that these quantitative data would serve as a statistically significant indication as to the causes of the response to beauty in costume and that these causes would be revealed still more definitely in the verbal reports.

Preliminary experimentation. Preliminary testing was made with one costume design after which 10 others were developed and refined into 16 groups, of four designs each; one group of three designs; and one group of two designs for the final experimentation. To these experts and non-experts gave both spontaneous and analytical responses.

Fifty university students responded in the preliminary experiment to one design and its 11 variations. Twenty-eight of the women and the 10 men previously had had little or no systematic training in art and none in costume design. Twelve women previously had had training in art and costume designing. Ten home economics students observed in the refinement of the remaining 10 designs with their variations.

Technique. For a trial exhibit one of the best of the 20 previously selected historic designs, dated 1750, was used. By redrawing this in an 8 in. figure in ink outline, and somewhat modifying it, the elements of color, tone, and expression by means of posture and face were eliminated. Eleven changes were made of this master design making 12 designs in all. These consisted in four variations of the size of the cuffs, the ratio of length to width being held constant, and three variations in the size of the over-skirt. Four of these are illustrated in Figs. 2, 4, 6, and 8. These designs were traced on a roll of tracing cloth 8½ in. wide by 4½ yd. long. Each design was given a chance position on the roll in an 11½ in. space.

This method of developing test-material having proved satisfactory through actual testing, ten other designs were selected from the 20 ranking highest of the 75 original historic designs in color. These were developed into test-material. Eight inch photostats were made from the original designs and tracings were made of these with only minor changes in drawing. The fea-

tures of the face were omitted as in the trial design. The designs were analyzed in order to ascertain what factors were responsible for their beauty. Some element which seemed most significant was then varied. Some of the designs presented greater difficulty than others in the control of all factors and for this reason the number of variations for each design was not the same as may be noted in the following:

Design no.	Date of design	No. of variations
(1)	1490	9
(10)	1520	12
(19)	1690	4
(50)	1710	8
(33)	1725	6
(3)	1750	12
(37)	1789	9
(41)	1850	7
(25)	1851	4
	1859	7
	1920	4
	Total	82

When the decision had been made as to the number of variations per design, the next step was to trace these in ink on tracing paper. These were pasted to 7 in. x 9 in. frames, made of black construction-paper and then mounted on white ledger-paper. Thus the design gave an appearance of being traced on opaque paper. This method was used rather than that of drawing the design on the illustration-board because of the ease and accuracy in reproducing the designs.

Apparatus—the modified variable factor frame. The modified variable factor frame was a simplification of the variable factor frame.[5] (Figs. 1a and 1b.) It was made of an 18 in. x 24 in. board. A brace was placed at the back to give an angle which would make the center of the design perpendicular to the line of vision. A piece of weather stripping was nailed to this frame four inches from the bottom. Four holes had been bored in this strip and four rings had been inserted and soldered. The designs

[5] The variable factor frame is described on p. 49 of the author's thesis "An Investigation of the Basic Factors of Æsthetic Value in Costume Design", Univ. of Iowa, 1931.

were placed in this frame as note book paper is placed in a loose leaf note book cover, with tabs for expeditious handling.

Procedure. The designs in the groups of 1750 and 1520 were displayed in the variable factor frame by the paired comparisons

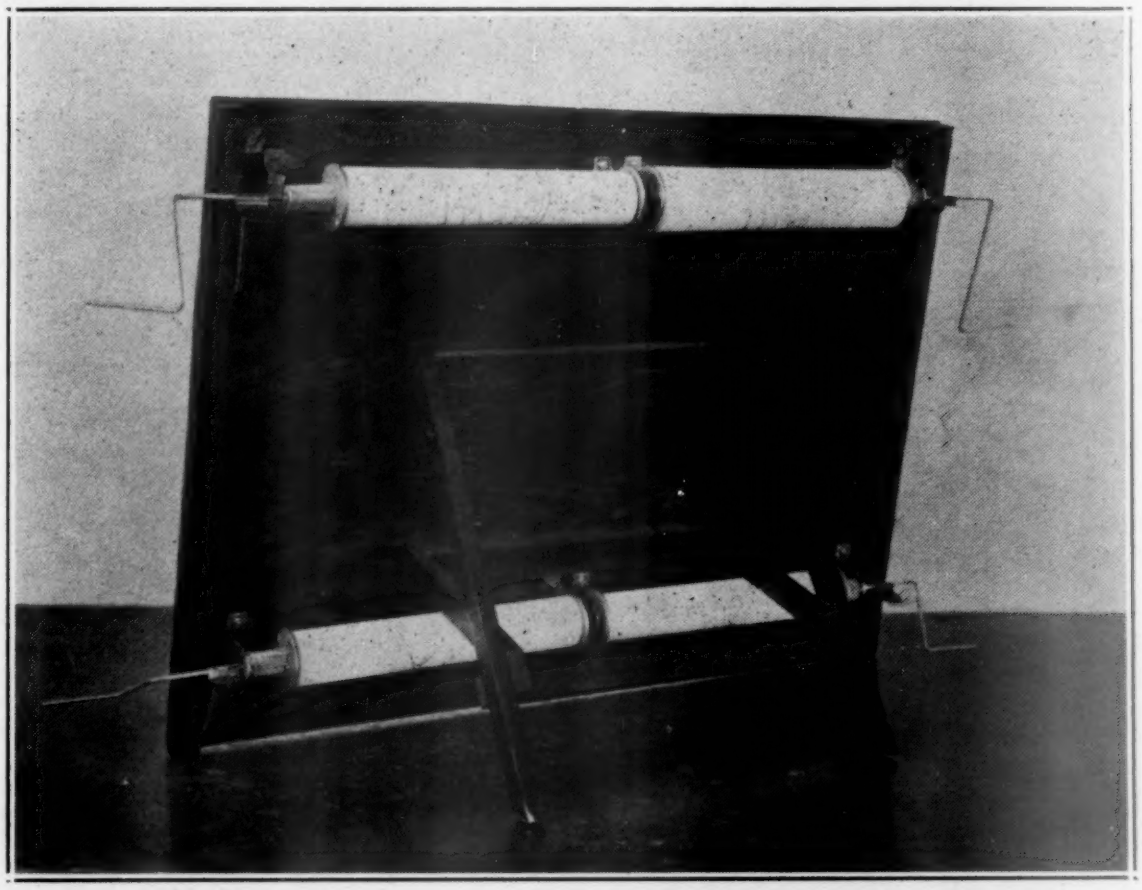

FIG. 1a. Variable factor frame

method. The subject was given a record-sheet on which to record his preferences together with the following directions:

Please write, on the record sheet, your name, the date, the time when you begin and the time when you finish; also state the amount of art or costume-design training you have had.

Two views of an historic costume are shown in the frames before you. There are 12 variations of this design; these variations exist only in the cuffs and over-skirt. In some comparisons only the over-skirt will be varied, in some only the cuffs will be varied and in others both the cuffs and the over-skirt will be varied.

Will you observe these long enough to give you a pleasant (satisfying) or an unpleasant (unsatisfying) feeling, basing your judgment on the record sheet in terms of the number of the design which you prefer, as: 2A. Your judgment is to be based entirely on your pleasant or unpleasant feeling, *i.e.*, whether you like one of the designs and find it more satisfying than the other. Do not stop to analyze them.

When you have made your decision turn to the next two designs called for on your record sheet.

The order of presentation of the designs was such that no design was judged twice in succession. By means of this procedure each design appeared on one side of the frame as often as on the other side. Each observer proceeded undisturbed and at his own speed. The average amount of time required for this procedure was 30 min.

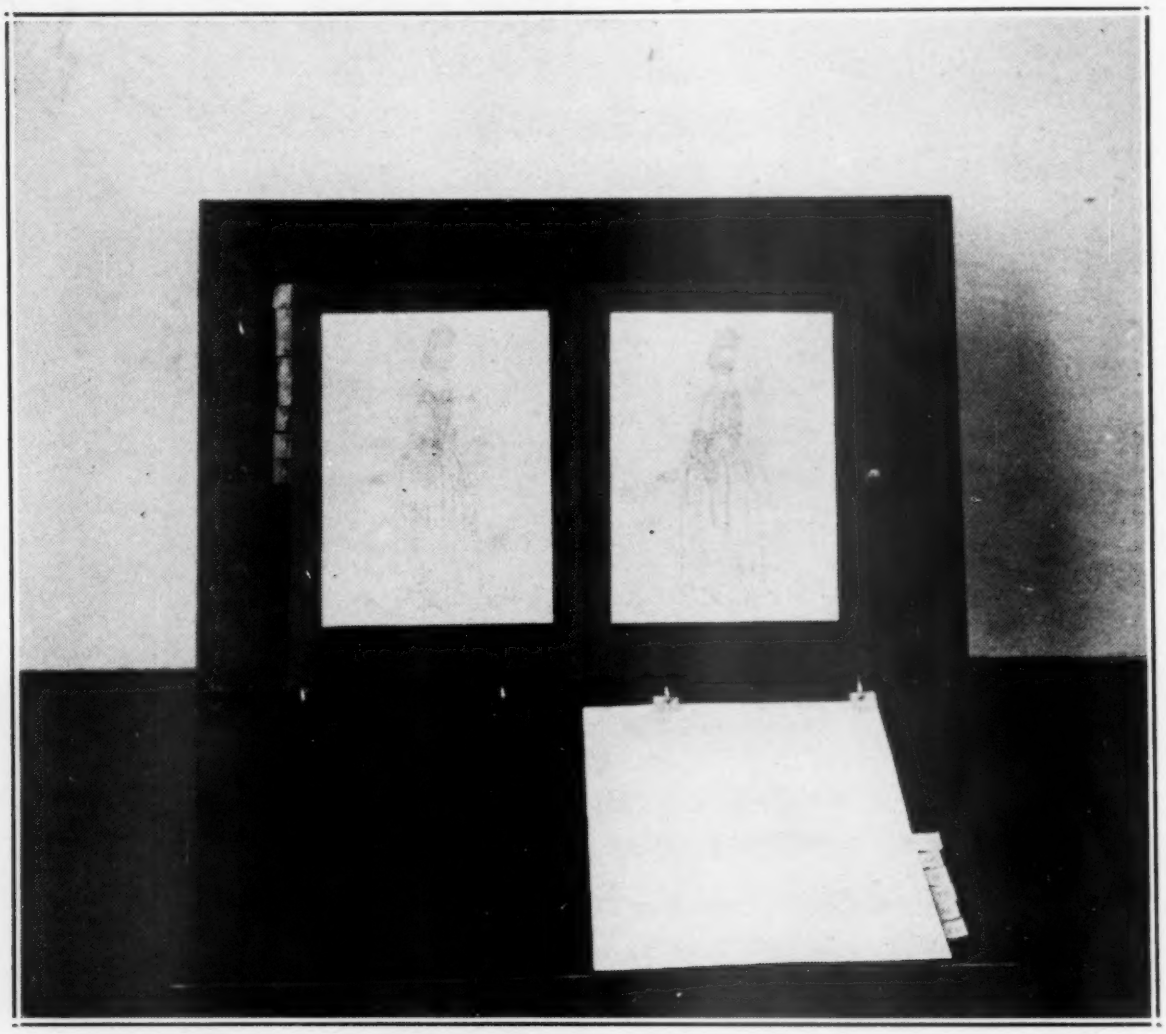

FIG. 1b. Modified V.F. frame

The procedure which was further followed in refining the remaining ten groups was the same except for the change in apparatus. In the case of the designs for 1690, 1851, 1920, and 1725, where there were four or six modifications in each group, a simple display-rack was used. The others were displayed in the modified variable factor frame.

Results of preliminary study. On the basis of this preliminary work, the 12 designs in the group of 1750 were divided into

three groups on the basis of the length of the over-skirt. The 12 variations for group 1520 were also divided into three groups but on the basis of the width of the fur on the skirt. The nine designs in the group of 1490 were made into one group of four designs. The position of the belt-line having proved a style factor, it was omitted and the cuffs remained the variable. The groups for 1710, 1725, 1789, 1850, and 1859 were refined by means of scaling. This made 16 groups of four designs each, one of three designs and one with two designs. Four of these groups are illustrated in Figs. 2, 4, 6, and 8.

Final experimentation. Subjects: The observers in the final experiment were 33 experts and 162 non-experts, also 24 students and instructors who were trained in the laboratory techniques of psychology. The experts were 15 teachers of fine arts, 16 teachers of costume design, and two women in business. Three of the teachers of fine arts were men, the others were women. The non-experts were individuals who had had little or no art training. Of these, 20 were home economics students who had previously had an average of seven academic semester-hours in art or costume design; 70 were students from the various departments, from freshmen to graduate students; 30 were mature women, mostly housewives; 30 were men students; six were colored women students and six were Filipino men students.

Materials and procedure. The testing material consisted of the 18 groups referred to above. These, when compared by means of the method of paired comparisons, constituted a series of 100 paired designs arranged according to chance, and were printed from zinc etchings in a 5½ in. x 8 in. booklet.

Directions, together with the two record sheets, definitions for proportion, balance, rhythm, and emphasis, as given in the report of the Committee on Terminology (**64**), a copy of the test material, and a personal letter, were sent to 40 experts. The directions on Record Sheet No. 1 were:

> The accompanying designs of historic costumes are arranged in groups of two. No pair appears more than once in the series. These designs are alike in every respect except one.
>
> You are to compare the two designs in each pair, noting the unlike part (as

stated below), then decide which one is better (more pleasing, more artistic, more satisfying). Base your judgment on your first reaction to the design as a whole; do not stop to analyze the designs or the reasons for your likes or dislikes.

Indicate your preference by drawing a circle around A or B depending on your choice as: [101] size of cuffs A B.

The directions on Record Sheet No. 2 were:

Analyze the two designs in each pair, determining whether A or B is better in proportion, in balance, in rhythm, and in emphasis. There may be other principles observed or violated. These, however, are not being considered in this study.

If both designs are good in proportion but A is better than B then indicate this by the letter A and a plus sign as: (A+); if neither is good in proportion but A is somewhat better than B then indicate by a minus sign as: (A—); if one is good and one is not, in your judgment, then simply indicate by A or B whichever you consider better. Make a choice in every case as:

No.	Proportion	Balance	Rhythm	Emphasis
101	A+	A+	A	B—

The non-experts were given a copy of the test material together with a copy of record sheet No. 1 and were asked to read the directions and proceed accordingly.

Results. The responses of the 33 experts and the 162 non-experts to the 100 paired designs are shown in percentages in Table V and illustrated in graph form in Figs. 3, 5, 7, and 9.

Though the resulting judgments have been classified as non-analytical and analytical, no sharp distinction can be made between them. *Bullough* (8, p. 80) says that "even a fraction of a second was not sufficient time to eliminate association and empathy." The thesis held by the writer is based on evidence from the observers who repeatedly were unable to account for the preference expressed. The average deliberate judgment by the expert was 5.26 min. and from 1 sec. to 47 sec. by the non-expert, while the non-analytical judgment in terms of the experts' and non-experts' average was less than 1.34 sec.

The non-analytical judgments comprise the quickly made preferences by experts and non-experts (A and B in Table V) as entered on Record Sheet No. 1. The correlation between the 33 experts and the 162 non-experts on the basis of the number of preferences for each design was .903±.023. The correlation found by *Cattell* (10, p. 334) was .33 between experts' and non-

TABLE V. *The per cent of non-analytical and analytical judgments as determined by experts and non-experts*

		Non-analytical		Analytical Judgments									
		33 Experts	162 Non-experts	21 Experts Preference				19 Experts Absolute				24 Non-experts Reasons	
Group	Design no.	A	B	C	D	E	F	I	J	K	L	G	H
I	3	84	76	74	76	74	72	68	68	53	46		
	2	50	56	60	60	62	54	54	60	56	44		
	1	50	52	50	50	50	56	44	40	65	60		
	4	16	16	16	14	14	18	14	16	21	16		
II	7	72	72	70	74	72	66	68	67	74	61		
	6	78	74	78	76	78	66	68	72	65	53		
	5	46	46	48	46	44	46	40	39	40	39		
	8	4	8	4	4	6	22	18	23	40	19		
III	12	82	82	80	80	80	80	79	79	82	75	56	44
	9	74	72	78	78	78	72	77	79	74	75	66	34
	10	43	42	40	42	40	52	46	63	42	51	31	69
	11	1	4	2	0	2	16	11	14	19	11	12	88
IV	13	80	82	86	86	90	72	84	84	88	68		
	14	74	68	74	76	76	72	54	60	58	56		
	15	42	42	36	36	34	46	26	28	35	65		
	16	4	8	4	2	0	10	9	11	19	14		
V	19	72	66	88	88	88	82	65	86	81	77		
	20	62	56	44	42	50	50	65	63	72	60		
	17	56	52	46	52	50	50	42	61	63	56		
	18	10	26	22	18	12	18	35	35	32	30		
VI	21	70	52	74	78	78	76	77	82	75	77		
	24	48	44	50	50	42	54	58	68	58	67		
	23	46	66	26	20	16	18	37	40	32	33		
	22	36	38	50	52	64	52	51	63	65	68		
VII	28	74	70	84	84	86	80	84	88	93	72	80	20
	25	68	58	68	68	56	66	72	77	76	70	61	39
	26	42	54	36	36	50	36	44	54	74	51	46	54
	27	16	18	12	12	8	18	54	54	33	42	28	72
VIII	32	84	76	82	82	82	84	81	88	75	84	82	18
	31	80	80	82	82	82	80	88	71	89	77	83	17
	29	30	32	28	28	28	26	46	51	23	30	15	74
	30	6	12	8	8	8	10	39	44	11	18	10	90
IX	33	86	68	84	86	82	84	86	93	91	82		
	35	68	80	70	66	70	66	84	82	79	65		
	34	32	42	34	36	36	28	47	46	49	40		
	36	14	10	12	12	12	22	21	18	25	19		
X	37	92	68	86	86	90	86	91	84	100	91		
	38	50	60	50	52	34	46	77	75	53	63		
	40	28	44	34	36	36	26	61	63	54	47		
	39	30	28	30	26	40	42	53	51	61	37		
XI	44	62	52	60	58	60	58	75	72	65	70		
	41	60	68	72	70	72	70	77	81	72	67		
	42	42	26	26	30	26	38	63	61	40	46		
	43	36	54	42	42	42	34	74	77	58	53		

TABLE V—*Continued*

		Non-analytical		Analytical Judgments									
		33	162	21				19				24	
		Ex-perts	Non-ex-perts	Experts Preference				Experts Absolute				Non-experts Reasons	
Group	Design no.	A	B	C	D	E	F	I	J	K	L	G	H
XII	45	86	74	84	84	86	80	81	88	88	70		
	47	56	56	42	40	50	46	33	51	58	46		
	46	50	56	56	56	56	64	56	54	61	63		
	48	8	14	18	20	8	10	21	28	12	21		
XIII	50	78	72	74	78	84	80	82	81	88	79		
	52	52	54	54	58	50	50	54	67	49	49		
	49	46	50	44	48	48	44	47	58	61	58		
	51	24	24	28	26	18	26	39	44	26	25		
XIV	56	46	50	44	42	48	50	57	61	54	54	13	87
	55	74	74	74	76	72	68	75	84	75	79	58	42
	54	70	58	70	72	70	68	77	82	70	67	77	23
	53	10	18	12	10	10	14	32	33	33	21	13	87
XV	60	44	52	48	46	50	48	46	58	51	58		
	59	66	66	66	66	66	68	58	63	54	61		
	58	78	64	74	76	72	66	53	61	56	54		
	57	12	18	12	12	12	18	12	15	23	16		
XVI	64	62	54	68	66	68	66	42	51	51	51		
	63	76	74	84	86	86	78	63	75	65	67		
	62	54	58	42	42	40	42	30	37	33	33		
	61	8	14	6	6	6	14	12	23	19	14		
XVII	65	62	55	60	60	59	60	89	95	92	84		
	67	33	32	26	26	19	26	63	63	42	47		
	66	5	13	14	14	22	14	66	68	63	55		
XVIII	68	64	71	67	67	76	67	66	89	79	79		
	69	36	29	33	33	24	33	82	79	63	58		

experts' ranking of 36 pictures, which indicates that he was dealing with a more complex situation. Inter-correlations were determined between the 33 experts and the following:

20 home economics women	.928±.012
70 women students	.918±.013
30 mature women	.899±.016
30 men	.845±.024

Similar findings have been reported by *Cattell* (10, p. 335). The inter-correlations show class and sex differences, but the number of cases is too limited to furnish conclusive evidence.

FIG. 2. Designs of Group III.

Analytical judgments made by experts and non-experts, are shown under C, D, E, and F in Table V indicating the per cent of comparative preference by 21 of the 33 experts whose responses could be tabulated for each design in each group. I, J, K, and L show the per cent of absolute value of each design illustrated in Figs. 3, 5, 7, and 9. These data were obtained from Record Sheet No. 2. The comparative judgment was indicated by A or B, the absolute judgment by the plus, minus, or no

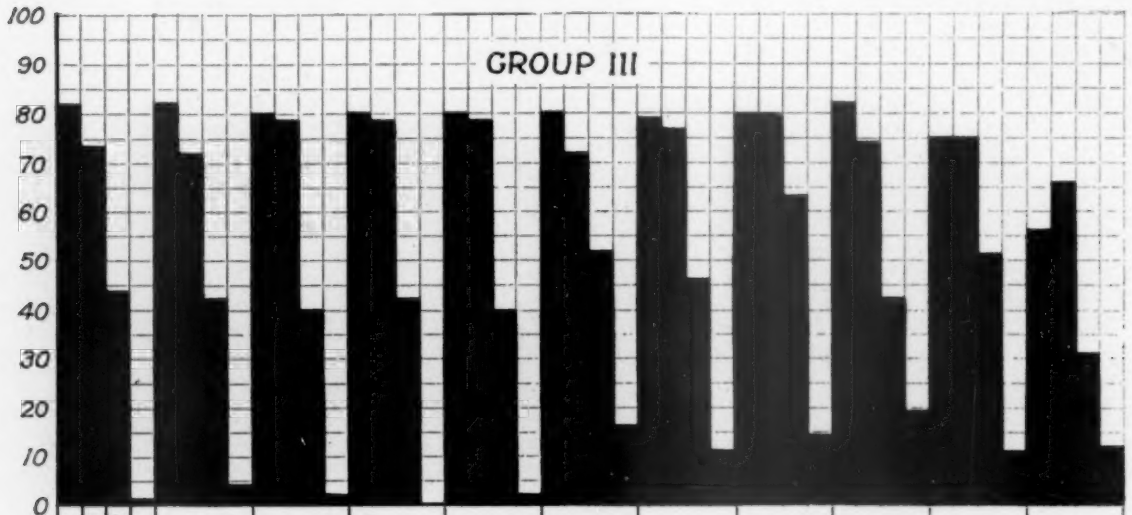

FIG. 3. Relative rank of designs in Group III by non-analytical judgments (A, B) and by analytical judgments (C to L) with art principles as criteria. The numbers at base of columns over A refer to the designs and are the same from A to G. C, I proportion; D, J balance; E, K rhythm; F, L emphasis.

sign. The results under G and H in Table V show the per cent of positive and negative reasons given by 24 men and women observers for their preferences.[6]

The correlation between the non-analytical judgment by the 33 experts and the average of the comparative analytical judgments[7] by 19 experts was .971±.005. The correlation between the non-analytical judgment by the 33 experts and the average of the absolute analytical judgments by 19 experts was .805±.03.

[6] These results will be further discussed under *Qualitative Testing.*
[7] This is assuming that each of the four criteria have equal weighting.

28

25

26

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FIG. 4. Designs of Group VII.

Qualitative testing. It was evident at this stage of the study that within each group and in the case of all 69 designs they varied in merit, ranging from 1 per cent preference in the case of one design to that of 92 per cent in the case of another design. The high correlation between the expert and non-expert preferences, also between the experts' analytical and non-analytical judgments (both preferences and absolute), indicate that at least the four principles of art are operative in *Gestalten* (or non-analytical) judgments and that the designs, in which these prin-

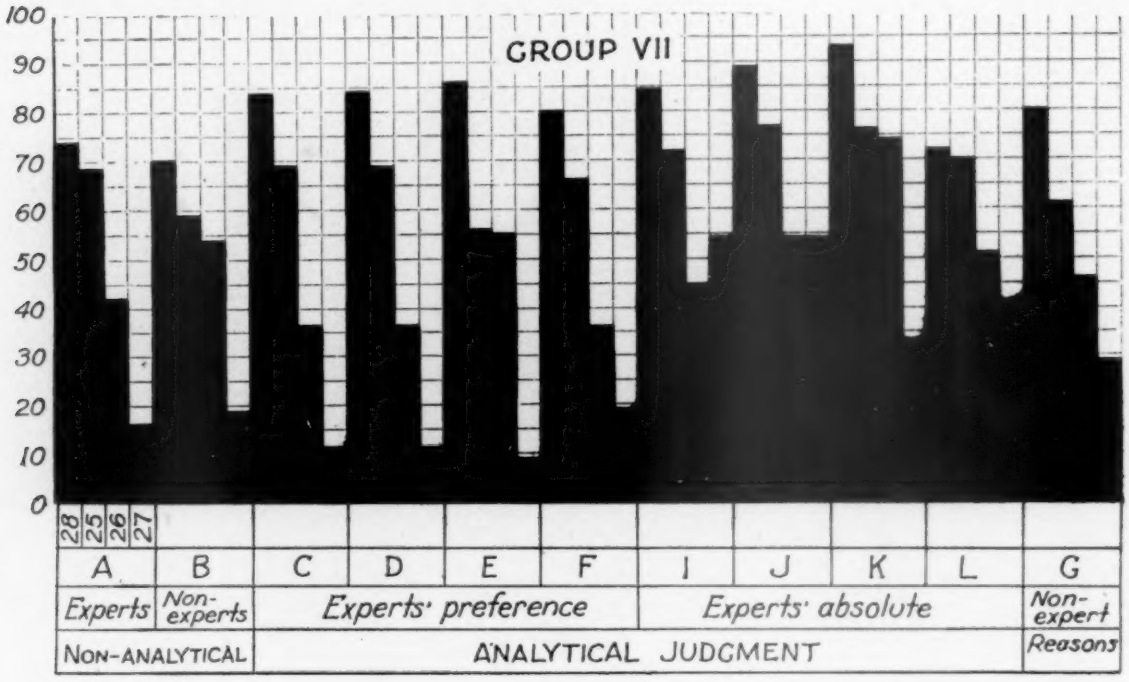

FIG. 5. Relative rank of designs in Group VII. (Same legend as Fig. 3.)

ciples are observed to the greatest extent, are liked best by both experts and non-experts. A further investigation was, therefore, made into the nature of these basic factors.

Materials and methods. Twenty-four subjects, nine women and 15 men, observed. All but four of these were students with advanced training in psychology. They gave their preferences and reasons in the case of 24 paired designs. These consisted of four groups of four designs each, namely, Groups, III, VII, VIII, and XIV, the designs being paired by means of the paired comparisons method. The observer was given the following directions:

Decide which of the two designs you prefer, limiting your judgment to the one factor which is varied but viewed in its full setting, and announce your

FIG. 6. Designs of Group VIII.

decision. Then study the situation and talk freely to the stenographer about what you experienced as you made your decision and what you now think are factors that influenced your decision. Be as searching and specific as possible.

Then turn to the next pair and proceed in the same manner. The object is to reveal in your report to the stenographer what factors in each specific situation seemed to influence your choice, quite regardless of general art theories. Avoid platitudes and mere verbal answers. Be concrete and express your personal feeling.

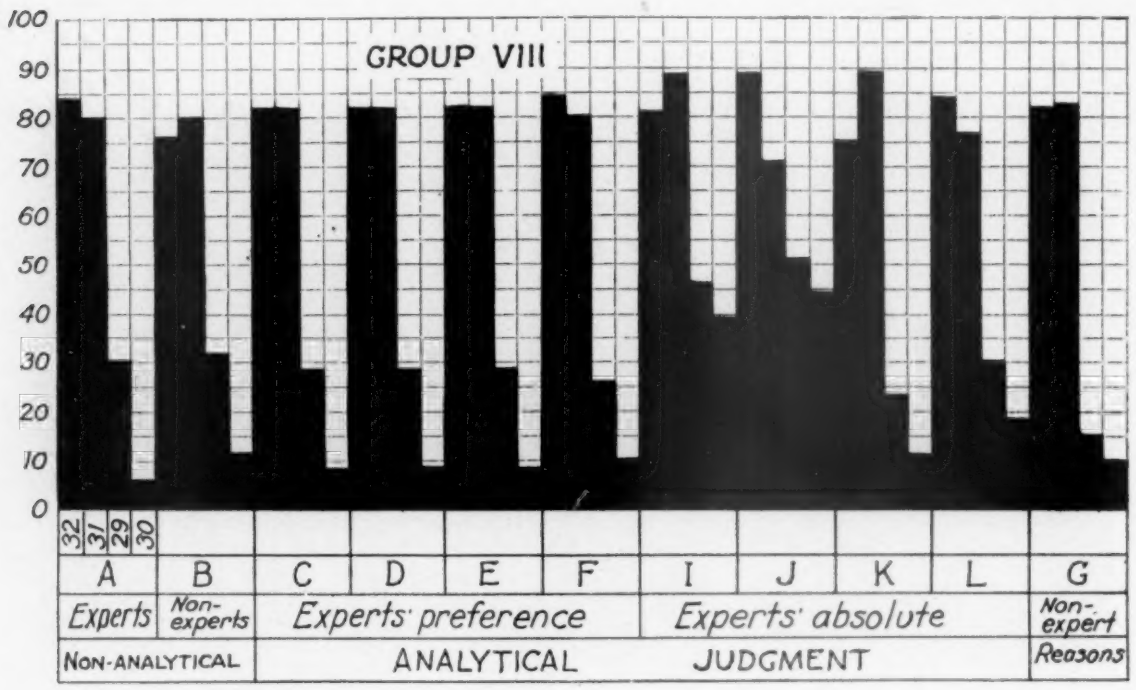

FIG. 7. Relative rank of designs in Group VIII. (Same legend as Fig. 3.)

The observer was then shown several designs of the original test which had not been included in the 24 paired designs. This was done in order that he might familiarize himself with the type of test material used. He was given the 24 paired designs and asked to place them one at a time on the display stand. He then gave his preference and the reasons, which were recorded by the stenographer. If the observer's reasons were not clear to the experimenter, he was asked to explain further. Each subject observed for one-half hour, 19 of the 24 observers completing all four groups in that length of time.

Interpretation of data and results. The responses given by the 24 observers resulted in 743 reasons which could be evaluated and classified. These data were treated in a similar manner as those of the Wyoming and Iowa groups of the preliminary investigation.

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FIG. 8. Designs of Group XIV.

The results of this treatment are shown in Table VI. The positive and negative reasons show that the designs were preferred in varying degrees as shown in percentages under G and H in Table V and in graph form under G in Figs. 3, 5, 7, and 9. It may be noted in these histograms that the preferences as expressed in positive reasons show the same general trend as the preferences by the experts and non-experts (under A and B) and also the judgments by the experts when based on each of the four principles of art (C, D, E, F, I, J, K and L) thus corroborating the previous findings. Though the elements of

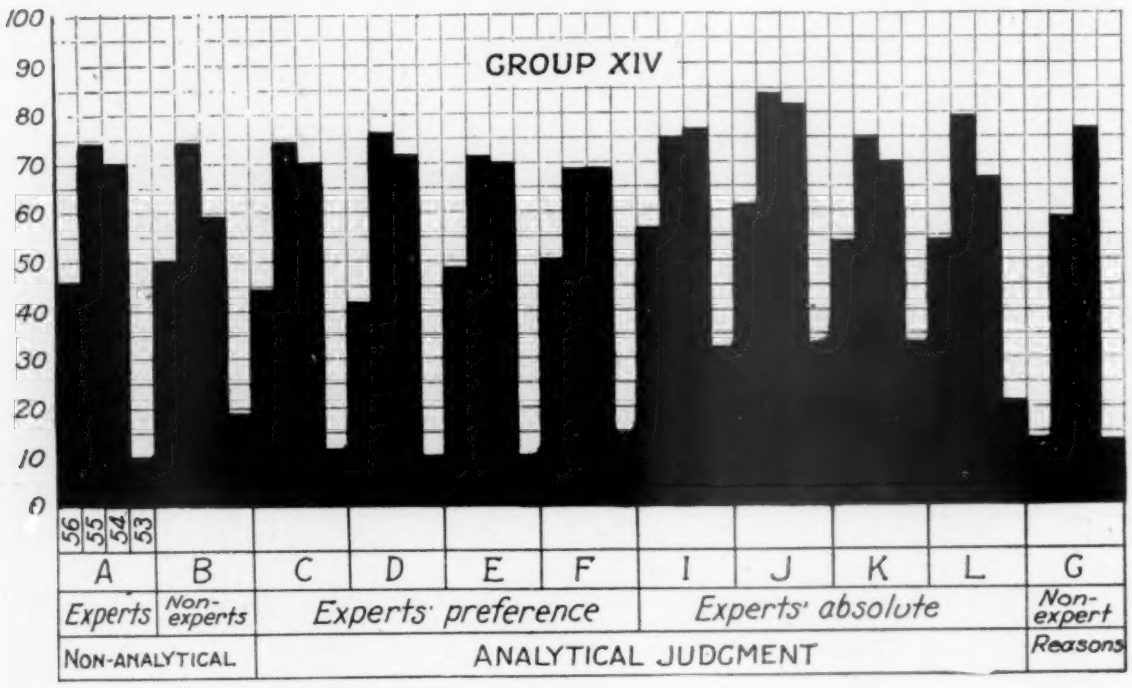

FIG. 9. Relative rank of designs in Group XIV. (Same legend as Fig. 3.)

form and line were controlled in these designs the factors serving as criteria of judgment were controlled only to a limited extent. Certain ones, however, served to influence the judgment more than the others. Proportion predominated in the designs of Group III showing a percentage of 29.5 in Table VI; it also predominated in the reasons of Group XIV as shown by the 60.8 per cent in Table VI.

Rhythm and *repetition* predominate in Groups VII and VIII showing percentages of 33.6 and 50.3 respectively as in Table VI. Some of these factors seem to have been based on (1) sense impressions of objective evidence, (2) others were attributable to mental conditions, (3) still others to social factors, and (4) some

to kinæsthetic empathy. Only the four factors of proportion, balance, rhythm, and emphasis will be discussed.

TABLE VI. *The per cent of reasons given by 24 observers for their preferences of the designs in the four groups*

	Group III	Group VII	Group VIII	Group XIV
Proportion	29.5	10.3		60.8
Balance	19.6	4.5		11.9
Rhythm	6.7	18.7	14.9	2.1
Emphasis	15.0	9.8	6.1	6.2
Contrast	1.0	2.2	4.7	1.5
Sequence				.5
Repetition		16.5	33.8	
Radiation		1.3	2.0	
Harmony	4.1	2.2	22.3	2.1
Unity	.5	13.8	6.7	
Continuity				.5
Fitness	8.3	.5	1.3	5.7
Economic				.5
Average	6.7	3.1	2.0	3.1
Association	2.1	7.1	2.0	2.1
Adaptation	2.1	.5		1.
Definiteness	1.2	1.8	2.7	
Conformity				.5
Empathy	1.2			
Drawing Errors	2.	5.8	.7	1.5
Order		1.8	.7	

Criteria based primarily on objective manifestations. Proportion is defined as quantitative relationship in magnitude in a work of art of part to part and part to whole (**51**). As one of these, it operates to give satisfaction or the lack of satisfaction, depending on whether the space relationships produce a balanced effect of weight or not, whether they create a pleasant or unpleasant empathic response or whether the relationship creates too much or too little attention in certain places. An analysis of the reasons tends to show that the deliberated judgment was on the basis of part-to-part or part-to-whole relationship in terms of magnitude and that rarely was the judgment based on the variable alone. The following reasons will make these points clear:

1. "The cuffs in No. 53 fit in better with the over-skirt than in No. 56."
2. "The skirt is full and would want the cuffs to be rather full, but they are too full in No. 53."
3. "The cuffs in No. 53 are unduly large for the rest of the dress."
4. "The cuffs are much too large in No. 53 for the size of the waist."
5. "No. 55 preferred. I can not tell why except that I just like small cuffs better."

Balance, defined as an opposition of equal forces, as a criterion based on objective manifestation, is altered by a change in spatial relationships as shown in Groups II and XIV. In Group VII the balance is disturbed by an excess of material in the ruffles of design 26. This balance is often expressed in terms of weight or stability, thus giving a complicated experience involving visual and kinæsthetic perceptions. The following reasons may make this clear:

6. "The cuffs in No. 53 are larger than in No. 54 and seem heavy."
7. "The balance is better in No. 55. There is a general tendency in the whole figure, beginning at the top and coming down in No. 55, and the cuffs don't distort this gradual process as you come down the figure, as in No. 54."
8. "No. 11 is top-heavy; it might tip over."
9. "The big cuffs in No. 11 make her appear too square, top-heavy. I think the large cuffs add about 20 lbs. to her weight."

Emphasis, defined as a method by which one feature is more important than all the rest, the others grouping with it in subordinate positions (48, 39, 24), as a criterion based on objective manifestation when attributable to size, influences judgment in that it directs attention (No. 10), it attracts attention (No. 11), it determines the relative value of parts (No. 11), it holds attention (No. 13), and it fixes attention (No. 14).

10. "I prefer No. 54 to No. 55. The costume demands more attention on the relationship between skirt and waist than attention to sleeves. It seems more fitting that the sleeves should be part of the background."
11. "No. 54 is preferred. The cuffs in No. 56 attract attention too much."
12. "There is skimpiness about the cuffs in No. 56 which draws attention to them."
13. "The wide cuffs in No. 10 center your attention there and it should not do this."
14. "There is a blank space in No. 28 and my eyes ran around in a circle because there was nothing to fix them on."

Rhythm, defined as variational orderliness felt as rhythm (22), as a criterion based on objective manifestations, is of lesser importance in the designs of Groups III and XIV, but of greater significance in Groups VII and VIII. Movement which may be rhythmic or non-rhythmic[8] may be created by a repetition of lines in the same direction (Nos. 15, 17); by the convergence of lines

[8] It could not always be determined from these reasons whether the movement was rhythmic or not. Therefore, it was inferred that they may be rhythmic and they were thus included in this category.

(No. 16); or by an arc or a circle (Nos. 18, 19). Movement directs attention (No. 16); it gives a feeling of freedom or mastery (No. 19); and it favors perception by unifying (No. 20).

15. "No. 9 is preferred to No. 12. The general line or the flow of the cuffs follows the costume lines better."

16. "There is a convergence in No. 28 which leads to the central portions of the figure which I like. This is not true of No. 27."

17. "The ruffles in No. 28 are parallel with the slant of her hand and these factors move your attention up further than in No. 26."

18. "I prefer No. 26 to No. 28. I have a feeling here that she is about to perform a ballet dance—such freedom of motion!"

19. "She appears more graceful in No. 28 than in No. 25,—as though she were going to fly."

20. "I like No. 28 better than No. 26. The ruffles in No. 28 turn in enough. They curve and in doing that direct the eye so as to make the different parts of the garment seem to be of one garment, but yet not enough to overshadow the waist entirely, as in No. 26."

Harmony, as a criterion based on objective manifestations, is evident in such expressions as, "fit in better," "belong together," "seem more in keeping," "seem to blend," and "conform to." Proportion is also expressed in terms such as these, but the comparison is always in terms of magnitude.

Harmony is a quality of experience. It is the effect produced on the individual when the relationship of parts is æsthetically pleasing. Its objective reference in this study is in the relationships of form and line and the reasons serve as a means of expressing these experiences which are due to sensory impressions. Illustrations showing harmony or its lack are such as the following:

21. "The long over-skirt and the cuffs in No. 53 are more in keeping than No. 56."

22. "My idea is that this costume (9) seems to be planned to have a certain line, and the cuffs either don't fit in, or they do. No. 9 fits in better with the flowing line of the costume than No. 11."

23. "No. 31 is preferred. The band in No. 30 is not attractive. The angles are out of joint with the rest of the figure and it is irritating."

Contrast, as a criterion based on objective manifestations, is of little importance as expressed in these reasons. In reason 26 the conflict may be due to a desire for plenty. The designs in Group VIII show a contrast which is liked as expressed in reasons 24 and 25.

24. "I don't care for the combination of straight lines and curves in No. 29."

25. "In No. 29 there is an attempt to combine a block and a curve pattern which I do not like."

26. "The cuffs seem to be so 'dinky' in contrast to the over-skirt; they do not seem to have enough material to finish the cuffs."

Sequence of size and position of spaces, as a criterion based on objective manifestations, tended to attract attention and to direct it throughout the design.

27. "Maybe the first thing which would attract my attention in No. 54 would be the over-skirt, then I would notice the cuffs making it seem pleasing."

Contiguity of figure (silhouette) served as an objective manifestation for judgment. If the figure made a pretense of being a definite simple pattern which could be comprehended easily as a triangle then the observer did not like to have it disturbed.

28. "No. 53 is over-exaggerated, in fact, it even cuts outside of the triangle more than in No. 55."

Order, as a criterion based on objective manifestations, is desired in costume design. It is dependent on the successful use of basic elements, according to the principles of arrangement together with good judgment and good "taste." "These," says *Whitford* (64, p. 45) "results in an art structure leaving the attributes of harmony and fitness and in supreme instances beauty." A desire for order and harmony is expressed in the following reasons:

29. "No. 30 is a confusion of blocks or angles with curved lines that don't fit."
30. "In No. 26 you have a feeling of confusion."

Unity, as a criterion based on objective manifestation, is largely dependent on emphasis in these reasons. The lack of unity is a disturbing factor in design 26. The observer's objections are to the crowded effect, the lack of simplicity, and the lack of belonging together. This is shown in reasons such as the following:

31. "No. 27 cuts off the figure into three tiers."
32. "I prefer No. 28. There is too much trimming on the dress in No. 26. It is sort of spread all over the thing and gives a jumbled effect, whereas in No. 28 there is a more—well it gives more the appearance of trimming than it is supposed to be."

Repetition, as a criterion based on objective manifestations in producing harmony, is especially desirable in design 31 and in the designs of Group VII. Repetition aids perception by unify-

ing (34). It results in a pleasurable harmonious feeling (33). The following reasons will illustrate:

33. "I like No. 31. The lines of the waist are all curved lines, and the curved lines of the band fit in better than No. 30."

34. "The curves in the line of the ruffles in No. 28 seems approximately the type of curve in the skirt. I like it. It may have something to do with a feeling of unity."

Radiation, as a criterion based on objective manifestations, finds expression in reasons such as the following: The observer's first reaction in the case of designs 25 and 28 was:

35. "No preference" then he proceeded to analyze as: "My preference seems to fluctuate. I look at the whole figure noticing the lines and the angles from the waist and then get a feeling of downward motion and then the ruffle gives an upward motion. I try to see some reason in that. My first preference was for No. 28, and then it seemed that the shape of the curve of the ruffles in No. 25 was preferable."

The convergence or radiation from the waist line in design 28 gave the observer a pleasant reaction. This reaction changed to an unpleasant one because the problem could not be solved. His "urge of mastery" was not satisfied, therefore he turned his attention and preference to a problem which he could solve.

Criteria of beauty based primarily on mental considerations. In this group of reasons the attention is directed away from the object and to conditions of previous experiences. The observer sees objective evidence in the design which leads him into thought processes including meanings in past experiences. Factors of this type are fitness, economic factors, average and standard, association, adaptation, and definiteness.

Fitness is one of these factors. The observer analyzes in terms of the fitness of the dress (no longer the design) for the purpose which it may be intended or for the purpose which the observer supplies from his own experiences.

36. "In design No. 53 in length the cuffs hang down too far. They would be in the road if they were actually in a dress. They would interfere with free movement. They extend up to the elbow, which would interfere with the freedom of movement."

37. "The cuffs in No. 9 are so large that they would interfere with the ease of carrying herself. They are less appropriate than No. 12."

Economic factors were used by the observer as a criterion of judgment based on mental considerations. Again, the thought

process extends to the garment and the individual involved. The affective quality of the response depends on the visual image of the garment or possibly on specific situations. Unity is desired by the observer and economic factors may intervene causing an unpleasant reaction. Reasons of this type are:

38. "No. 53 is preferred. Design No. 56 looks like she ran out of material before she put on the cuff."

The *average and the standard,* that is, conformity to type, constitutes a basis for judgment. A preference for the average size in cuffs was apparent in the explanations as shown in reason 39. The standard as criterion is evident in reasons such as 40.

39. "No. 54 is preferred to No. 53. I think perhaps the conformity to a standard is the principle. I think perhaps it may be an indication of conservatism tending toward a happy medium rather than an extreme. In general I am more inclined to choose a happy medium."

40. "I think again I have a standard in mind and the ruffles in A fit in better with the standard."

Association served as a criterion of judgment. These factors may be personal or impersonal—a classification which was also made by *Feasey* (20, p. 257). The former refers to self or to a person, the latter to objects.

Personal

41. "Design No. 28 preferred. The dip in No. 26 is so pronounced that you get the same feeling as when looking down a steep hill. I don't like great depths. In No. 26 there might be a motor accompaniment. I had a vague image of a roller-coaster where you have a steep incline opposed to one which isn't so steep."

Impersonal

42. "Design No. 27 looks like hoops on a barrel."

43. "I like the inverted flower effect, tulip effect in No. 26." (Compared with No. 25.)

Adaptation served as a criterion of judgment. One may become conditioned so that the designs which were not liked may give a pleasant reaction. Habituation may have the opposite effect, *i.e.,* a design which was liked at first, when seen repeatedly, may produce an unpleasant reaction. The following reasons may make this clear:

44. "I think now that No. 55 is better than No. 53. I change my mind after a while. I don't seem to be consistent. I am tired of looking at the big cuffs. I seem to have changed my mind."

45. "I like the smaller cuffs in No. 55 better than No. 53. I think that is due to the fact that I am not used to the larger ones. At least it is more pleasant to see smaller cuffs."

A lack of *definiteness* influenced the observer's judgment. Reasons in which this attitude are expressed are:

46. "Design No. 30 is better than No. 29. Design No. 30 is complete in itself, or in its thought. The square idea is carried out but in No. 29 the dressmaker did not know whether to make it square or round. The one is finished and the other is not."

47. Design No. 25 is preferred to No. 27. As long as they are going to make the ruffles somewhat straight it is better to have them almost straight."

Social criteria as a basis of judgment. Conformity as a social urge serves as a criterion of judgment in the case of fashion. To illustrate:

48. "I think of my wife's dress. It has large cuffs which are in vogue now, therefore I like No. 54 better than No. 55.

Criterion of judgment based on empathy. Some of the reasons seem to suggest *Einführung* (empathy) as:

49. "In design No. 12 the lower part of the cuff is so much larger than the puff that you can almost feel the lines of the upper arm expanding."

50. "I prefer No. 10. Design No. 11 seems bulky, congested, stuffy, looking as though it made breathing difficult."

51. "I have a feeling of freedom in No. 28 which I do not feel in No. 25."

Summary of third phase. The purpose of the final stage of the study was to investigate the cause of some of the basic factors of æsthetic value. To do this it was necessary first to develop and refine the test-material. The method of paired comparisons was again used for this purpose and also for the purpose of obtaining the reactions of both experts and non-experts to four basic factors. An intensive analysis of verbal reports was made finally.

The results tend to show (a) that the method of scaling (*i.e.*, systematically varied proportions) lends itself admirably to refinement of this type of experimental material, (b) that traced designs in outline, which eliminated texture, style and other variables, were also found of service, (c) that the modified variable factor frame was found well adapted for presentation by the method of paired comparisons, (d) that the time element was found to be unimportant—an *ex post facto* response without

rationalization may be as accurately indicative of æsthetic enjoyment or correct sensing of æsthetic quality as a more deliberate judgment—(e) that whether the judgment of beauty is by experts or non-experts, is analytical or non-analytical, similar results follow.

The results tend to show further, that when beauty which is ordinarily complex is reduced to few factors there is the greatest agreement. This probably accounts for the high correlations found between judges. When the situation is complex extraneous and minor considerations may enter in to vitiate judgment.

Various factors were found to satisfy the æsthetic impulse. Certain *space relationships* created a sense of balance or lessened tension by directing attention by means of a sequence of spaces; *balance* created an experience of stability and equilibrium; *rhythm* directed attention, provided a feeling of freedom and mastery, and favored perception by unifying; *emphasis* lessened the strain of attention by attracting, fixing, directing or holding attention; *unity* favored perception by lessening the span of attention by means of order; *repetition* favored perception by creating a feeling of unity.

Previous hypotheses were confirmed in these experiments, namely, (1) that the æsthetic impulse in varying degree is a possession of the masses; and (2) that beauty in costume designing is associated with at least four of the well-established principles of art, namely, proportion, balance, rhythm, and emphasis.

VI. General summary and conclusions. The general objective of this study was to seek an explanation of beauty in costume design by means of test procedures.

In the first phase some general factors involved in costume design were disclosed by data obtained from two sources and by two methods on 198 women and 126 girls in Wyoming and 29 college women at the University of Iowa. The dual choice procedure was supplanted by the method of serial order of merit which was used, with variations, throughout the remainder of the experiments. From a large number of historic costume designs 75 were chosen, ranked by judges, and 20 selected, including both extremes.

In the second stage effort was directed toward an isolation of those factors which are basic, which, more than any others, convey æsthetic value to the costume design. A tentatively satisfactory criterion was settled upon in the thesis that consistent concurrence of similar reactions by large numbers of individuals indicated the fundamental basis of beauty. This was derived mainly from a quantitative analysis of 2,823 reactions by subjects.

The third phase was an investigation of the reasons why these factors are basic, or a determination of factors based on objective manifestations and on mental responses which would serve as a criterion of one's preference for the beautiful costume over the one not regarded as beautiful. For this purpose experimental variations were made of a number of historic costume designs in such a way that some strong feature of the design was altered in order to produce variations in æsthetic value. To these 100 paired experimental designs, presented in an order of paired comparisons, 33 experts and 162 unselected subjects gave preferences in spontaneous and analytic judgments. An absolute value was also assigned to 69 of the designs, using four accepted principles as criteria. Twenty-four subjects gave introspective reasons for their preferences to designs in four of the groups, each group being composed of one of the historic designs and three variations with only one variable element in each.

The study resulted in the following conclusions:

1. Of a number of factors serving as criteria of beauty, those of primary significance are the general qualities apt to be found in all good art, namely, proportion, balance, rhythm and emphasis. This finding was verified in three ways from the analytic responses of experts and unselected subjects.

2. The æsthetic impulse is general in that it finds definite expression in the language of both artist and layman, though it varies in degree with individuals.

3. When beauty, which ordinarily is complex, is reduced to the fewest possible variables the æsthetic impulse in both experts and non-experts is stimulated in a consistent manner.

4. The larger proportion of "no reasons" indicates that

younger persons (girls 10 to 18 yrs.) are less analytical than mature women.

5. The æsthetic impulse finds satisfaction (a) in certain space relationships when they tend to create a sense of balance or lessen tension; (b) in balance in that it creates an experience of stability and equilibrium; (c) in rhythm when it directs attention or favors perception by unifying; (d) in emphasis when it lessens the strain of attention by attracting, fixing, directing, or holding attention.

6. The serial order of merit method in determining factors and the method of paired comparisons in refining test material were found to be satisfactory procedures in the measurement of beauty in costume design through the various phases outlined. Likewise the two forms of the variable factor apparatus, designed for this study, proved their feasibility for such use in connection with the method of paired comparisons.

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